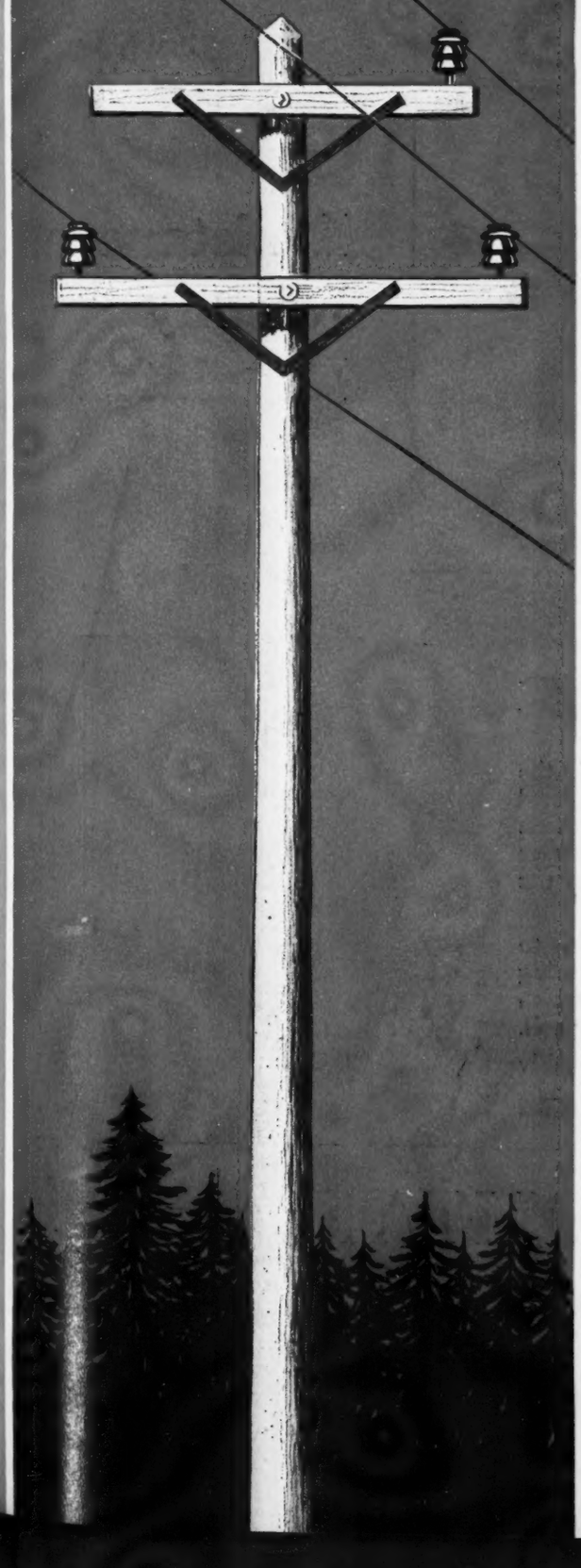
MAY 27 1930

ELECTRICAL WORLD

May 24, 1930 A McGRAW-HILL PUBLICATION 25 cents per copy



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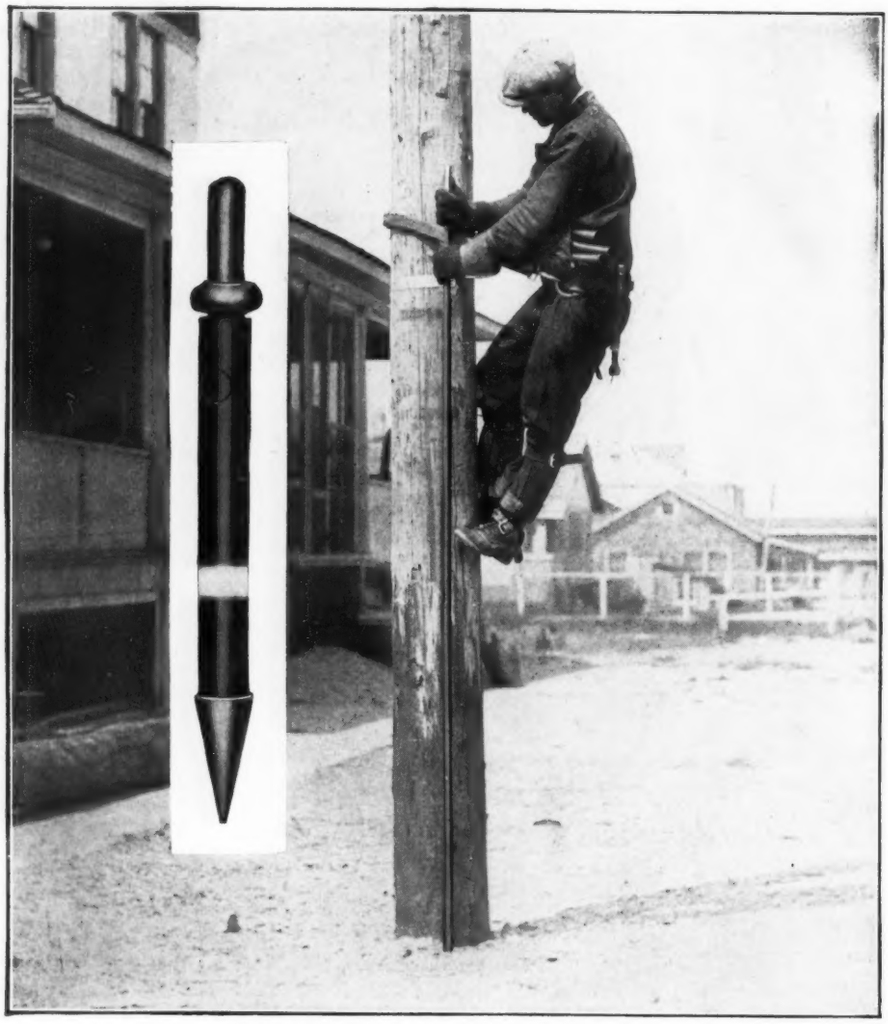

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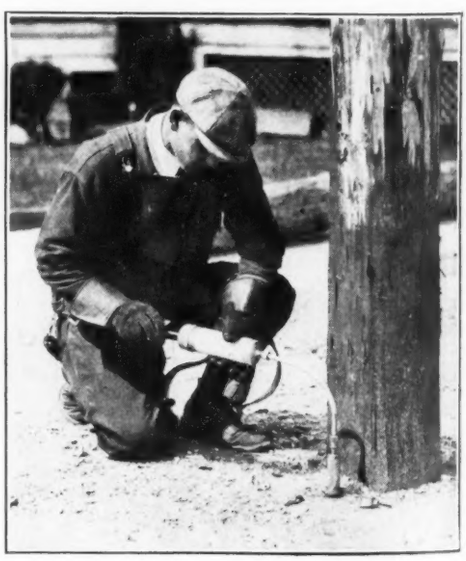

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ELECTRICAL WORLD

A consolidation of Electrical World, Electrical Engineer and American Electrician

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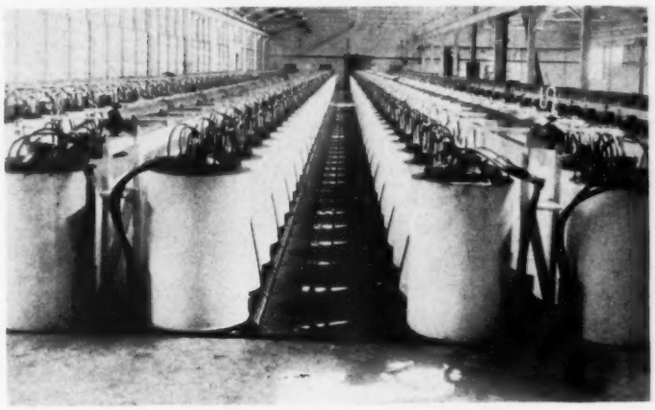

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Contents Copyrighted, 1930, by McGraw-Hill Publishing Company, Inc.

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McGRAW-HILL PUBLISHING COMPANY, INC., Tenth Ave. at 36th St., New York, N. Y.

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CABLE ADDRESS: "MACHINIST, N. Y."

Published weekly. $5 per year. 25 cents per copy. Entered as second-class matter, January 20, 1907, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Printed in U. S. A.

Member A.B.C.
Member A.B.P.

NUMBER OF COPIES PRINTED THIS ISSUE, 18,525

NEW YORK District Office, 285 Madison Avenue
WASHINGTON, National Press Building
CHICAGO, 520 N. Michigan Avenue
PHILADELPHIA, 1600 Arch Street
CLEVELAND, 501 Guardian Building
ST. LOUIS, 1556 Bell Telephone Building
SAN FRANCISCO, 883 Mission Street
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ELECTRICAL WORLD

for the Week Ending

May 24, 1930

Flathead project receives license

Standardization is N.E.M.A. keynote

Ontario votes electrical farm aid

Advertising urged for industry

—3,741 KW.-HR. per capita is Winnipeg's claim for high energy utilization record. New Seven Sisters Falls project is rushed to keep up with the demand.

—SAMUEL INSULL talks gayly of the "old days" when his industry was young. Financing was the big problem then. Relatively small sums loomed large.

—HYDRO PROJECTS again to the fore. Flathead development in West may ultimately be our third largest. Canada has same claim for Chats Falls on the Ottawa.

—N.E.L.A. - N.E.M.A. agreement on preferred voltage ratings. Report of joint committee offers ratings for generators, transformers and breakers satisfactory to both groups.

—INDUSTRIAL plants make electricity a by-product and tie-in with utility lines. Aluminum company hydro and Louisiana steam plant latest adherents to the plan.

—ASSOCIATED Gas & Electric in bad graces of New Hampshire authorities. Bond issue suspended from sale. Money ordered refunded by investment houses. Explanations and probe due soon.

—COPPER market returns to sales volume of "just an average week." Price apparently stabilized at 13 cents. Producers cut dividends.

—UNPROFITABLE services not separable, is U. S. Supreme Court decision. Columbia, S. C., to regain street railway service after five years by decision adverse to Broad River Power Company.

NEWS OF THE WEEK

Flathead River Power Project Awarded Federal License

STUDIED attacks from various angles have been directed against the Flathead project of the Rocky Mountain Power Company for the past nine months. Despite all this agitation, the Federal Power Commission, on May 19, authorized the issuance of a license to the Rocky Mountain company for site No. 1 on the Flathead River. Four other sites of much less importance are left open for future determination. Before final issuance the license must be approved by the legal division of the Interior Department, but since it was drawn with great care under competent legal guidance, that qualification is regarded as a perfunctory one.

Wheeler continues to dispute power company award

Walter H. Wheeler of Minneapolis, who filed a conflicting application, served notice on the commission that he would exercise the right of appeal and demand a review by the Cabinet members composing the Power Commission. Since the members of the commission voted unanimously to authorize the license, it is assumed that their position will not be changed by any hearing that may be granted Mr. Wheeler, who already has been heard at great length in defense of his project. In this event, Mr. Wheeler states that he expects to carry the case to the court. Secretary Wilbur, in announcing the results of the meeting, stated that "the accepted plan gives a sure rental to the Indians rather than to involve them in a speculative enterprise such as the bringing of possible new industries into an area distant from normal markets. The present plan can be carried out promptly, since the Rocky Mountain Power Company is ready to begin operations at once."

Indians to receive $1.85 a horsepower for rental

In its original application the power company offered to pay $1 per horsepower to the Indians, whose reservation includes a portion of Flathead Lake and the actual power site. After careful study of the matter, however, the commission required a flat rental which, over the twenty-year period set up in the license, averages $1.85 per horsepower. While the project is under construction the Indians are to receive $1,000 per month. Construction is expected to take three years. A period of five years is then given to build up the lead, during which the rental on a progressive scale works up to $125,000. This is stepped up until the annual rental reaches a maximum of $175,000. At the end of twenty years there is to be a restudy of the rental and provision made for a readjustment. The total

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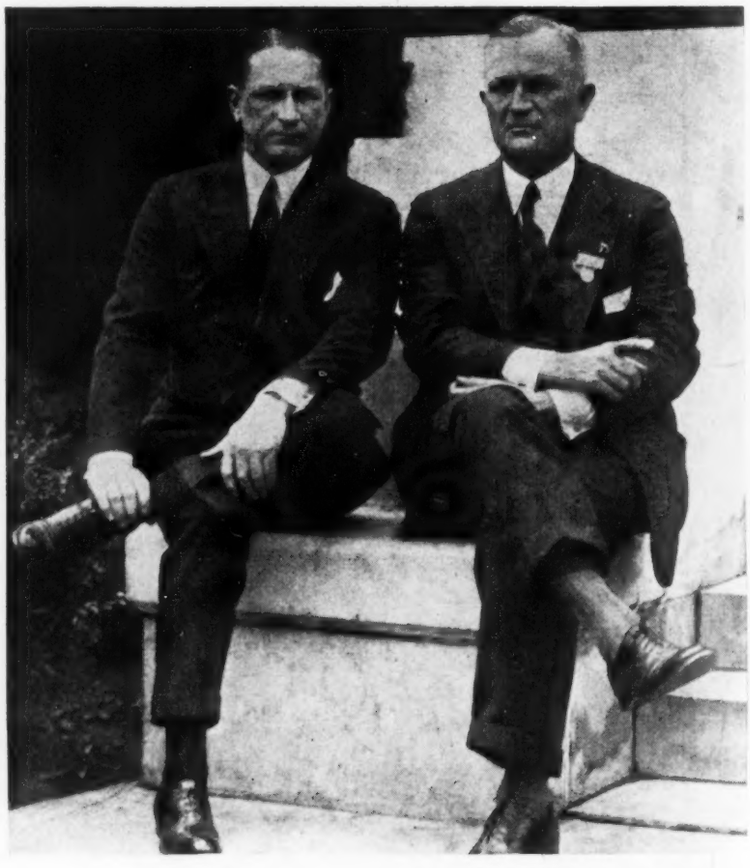
PRESIDENTS ALWAYS——



M. S. Sloan, president of the National Electric Light Association and numerous New York City electric light and power companies, was the guest speaker at the recent convention of the Southwestern Division, N.E.L.A., in Hot Springs, Ark. Harvey C. Couch, chief executive of many utilities in the Southwest and known as the "Empire Builder" for the part that he played in electrical development there, was elected president of Southwestern Division, N.E.L.A.

UTILITY OFFICE WINS PLACE IN PASADENA CIVIC CENTER

This new $275,000 Italian Renaissance office of the Los Angeles Gas & Electric Company is located in the civic center of Pasadena, Calif. Beautiful buildings are becoming virtual necessities on the Pacific Coast and this one appears worthy of the best surroundings. Complete with auditorium, display rooms, lunch room and commercial offices, it is representative of the modern utility trend. Landscaping is a feature

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rental for site No. 1 during the twenty years will be $2,845,000.

In addition, provision is made for the interests of the white settlers on the reclamation project. The license provides that power is to be furnished for pumping at a rate of 1 mill per kilowatt-hour for the first 10,000 hp. That power is reserved exclusively for pumping purposes. An additional 5,000 hp. is to be added, however, at the rate of 2½ mills, which may be resold for the account of the reclamation project. The power company also will pay the federal government $101,000 by way of reimbursement for the work already done on the Newell tunnel. Much of the opposition to the power company's application came from interests little concerned with the actual project but who are working for broad changes in the law pertaining to the production and distribution of power.

▼

Utility Advertising Men Consider Publicity Plans

"THERE is too much at stake in this electric light and power industry for us to sit idly and quietly by and let prejudice be used against us, out of ignorance on the part of the public," said P. S. Arkwright, president Georgia Power Company and chairman public policy committee, N.E.L.A., before the Public Utilities Advertising Association in Washington this week.

"If we do, it is our own fault. We have a wonderful story to tell. We will tell it and tell a much more wonderful one in the future of the added use of electricity, of greater economies and more extended areas to be served."

That utility advertising in local newspapers does not act to shape editorial policy was vigorously brought out by Herman Roe, field director of the National Editorial Association. Mr. Roe's findings were based on a questionnaire survey which brought frank comments on both sides of the question from local editors all over the country. More than one reply showed a tendency of newspaper men to "whale the power people when they needed it" and to praise them when they came across with something good, such as a voluntary rate cut, in either case without apparent effect on advertising. Reports from 34 states showed satisfaction with service and rates.

E. S. Friendly, business manager of the New York *Sun*, stated that utilities are spending entirely too little for advertising. His conclusions were based on Federal Trade Commission statistics. O. A. Conner, financial editor of the Philadelphia *Public Ledger*, pointed out that the widening distribution of utility stocks makes a new source of public interest in utility matters which should be satisfied by more advertising.

Massachusetts Legislature Receives Reform Bills

BILLS designed to give to the Department of Public Utilities certain supervision of holding companies have been reported to the Massachusetts Legislature by the committee on power and light. They would enlarge the jurisdiction of the department by providing control over contracts for payments of services and for purchases of electricity. All contracts would require filing with the commission, as would bulk sales rates. Annual reports would include statements under oath by each officer and director showing his affiliation with other public utility interests. The authority of the department would extend to affiliated companies.

Another bill reported by the committee provides that if a town which votes to establish a municipal lighting plant fails to agree upon the price, the department shall determine. It is provided that the price shall be determined without enhancement on account of future earning capacity or good will or of exclusive privileges and that it shall not be less than the aggregate amount of money paid in on stock less depreciation.

Another of the reported bills prohibits a town which has acquired a municipal lighting plant from selling it except by vote of the inhabitants and approval of the department.

WHEN THE FLEET'S IN THE RIVER'S A SHOW

Thousands of New Yorkers, crowding to see the battle fleet in the Hudson, made Riverside Drive during the past few weeks as congested as Broadway. They got a good free show, though. Searchlight drills are always impressive and the Navy is ever organized for concerted action

Bond & Share Hearings Now Await Legal Action

FURTHER Bond & Share hearings will be held if the Federal Trade Commission wins its suit to subpœna books of account, according to the latest interim report of the utilities investigation. This means that in addition to the National Power & Light Company, which was untouched in the sessions closing a few days ago, affairs of the parent company and of the two other subsidiary groups will be reopened on a broad scale if the court decision throws open the company ledgers to full scrutiny. So far Judge Healy and his staff have been able to bring out a broad base of facts regarding the management of the Bond & Share properties. They have been able to produce most of the general records of receipts and expenditures. What they lack and want is a further breakdown showing the broader elements which make up these charges. It is said that they do not intend to establish whether an individual rate is "fair," but under Senate resolution they feel both empowered and compelled to lay a factual background whereby Congress can judge whether general charges and practices are "proper" and in the public interest.

Legal action to establish whether the commission or the company is right under existing law still awaits the appointment by the New York District Court of a special master to take evidence. After the commission staff has disposed of examination of the North American Company, it is expected that steps will be taken to press the case toward a decision.

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By-Product Electricity to Feed Utility System

CONSTRUCTED to furnish the steam and power requirements of the Baton Rouge refinery of the Standard Oil Company, one of the largest in the world, the new Baton Rouge plant of the Louisiana Steam Products, Inc., will also furnish by-product electricity to the transmission system of Baton Rouge Electric Company and Gulf States Utilities Company, other constituent companies of Engineers Public Service Company.

The construction of this plant, which, according to C. W. Kellogg, president of Engineers Public Service Company, has cost approximately $6,000,000, has been rushed to completion by Stone & Webster Engineering Corporation in a period of less than seven months. The boiler plant is capable of furnishing more than 6,000,000,000 lb. of steam annually, or sufficient steam for a power station of 190,000 hp. capacity. Actually, only 60,000 hp. of electric generating capacity is being installed, since the main purpose of the plant is to supply steam for the refining processes of the Standard Oil plant, the electricity generated being a by-product.

Marketing Problems Dominate N.E.M.A. Meeting

POLICIES and standards were the principal subjects discussed at the convention of the National Electrical Manufacturers' Association held in Hot Springs, Va., this week. An attendance of 450 was registered, one of this association's largest meetings.

At the policies division meeting several important industry problems were discussed. The place of the large and small manufacturer in the modern production and distribution organization was featured and served as a base for a discussion of general problems in trade practices and commercial operations. The value of a firm price policy, the announcement of executive intent and purpose in trade practices, the establishment of adequate statistics on production and markets, policies in standardization, promotional development of electrical devices and methods for industry co-operation were typical topics of discussion.

Marketing co-operation with other industry groups considered

General industry problems discussed during the week included a closer study of the proposed Bureau of Standards plan for developing what might be called standard federal specifications for commodities. This proposal was deemed worthy of study to see what it would mean to standard brand products and to the promotional aspect of electrical

markets. Also the growth of local inspection rules in cities and towns was deemed worthy of study, as this bears directly on the development of home markets. It was felt necessary to keep in close touch with these developments and to co-operate closely with other industry groups in promoting certain electrical markets such as lighting the homes, electric heat and electric refrigeration in connection with standards work.

Standardization opportunities seen in several lines

In the several section meetings standards appeared to be the center of interest. These standards dealt with mechanical simplification and mechanical details in some apparatus and with voltage ratings and clearances in others. Circuit breakers, motors, disconnect switches, fuses, inclosed switchgear and other apparatus offer opportunity for a greater degree of standardization.

The enlarged N.E.M.A. appears to be a closely knit and busy organization, representing all electrical manufacturers, and President C. L. Collens stressed the importance of keeping it responsive to broad industry problems as well as those inherent to manufacturers. Much work has been done, but much remains to be done.

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Boulder Dam Question in Executive Sessions

ARGUMENTS in favor of an appropriation of $10,660,000 to start work at Boulder Dam were presented on Monday before the House committee on appropriations by Dr. Ray Lyman Wilbur, Secretary of the Interior, and by Dr. Elwood Mead, chief of the Bureau of Reclamation. As usual with appropriational matters, the hearing was in executive session. More than usual secrecy surrounded the proceedings. So far as the government witnesses went, it is understood that nothing was said beyond a strictly engineering explanation of why the stated sum is required.

During the hearings on Tuesday, Arizona witnesses presented their arguments against the approval fund requested by the Interior Department. It is understood that the main line of attack was directed against the contracts whereby the department has sought to underwrite the power output of the project as required under the terms of the Boulder Canyon act. The contracts were recently signed in California.

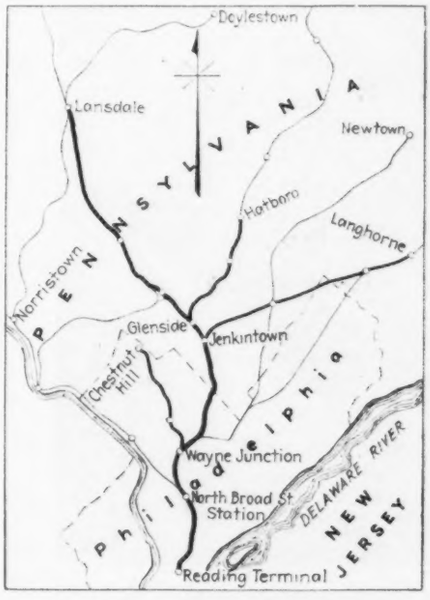
From the present outlook it still seems likely that the appropriation will be granted and that Arizona's redress will come through the courts.

Reading Electrification to Operate Next Year

ERECTION of catenary supports for the Reading Company electrification out of Philadelphia is progressing rapidly. It is contemplated that operation of the Philadelphia-Lansdale branch on purchased power will start about July 1, 1931. Upon completion of this branch, electrification of the main line as far as Langhorne and the Hatboro and Chestnut Hill branches will be started. Ultimately electrification to New York, Bethlehem and Reading is expected. An appropriation of $300,000 to cover work on the Doylestown branch has just been made. The total cost of the electrification will be $52,000,000, the first part of which will be $20,000,000.

Contract for power runs for twenty years

The contract for purchasing power from the Philadelphia Electric Company was signed January 7, for a period of twenty years. At the end of this period the Reading Company may extend the



Reading railroad electrification in Philadelphia district

contract for ten years. It may also terminate the contract at the end of ten years, provided equipment installed exclusively for it is purchased. Fifty per cent of the energy required during the first year's operation will come from Conowingo and the remainder from steam-generating plants.

Approximately 25,000,000 kw.-hr. will be used per year for suburban service at a cost of about $300,000 a year. After the through passenger and freight trains are electrified the consumption will be about 200,000,000 kw.-hr. a year, bringing the yearly expenditure for power to about $1,500,000 annually.

Overhead supply at 12,000 volts to be used

Single-phase alternating current at 12,000 volts will be used for propulsion of trains. Overhead trolley wires will be installed and the pantograph type of current collector used on cars and locomotives. A power supply substation will be erected at Doylestown, which will be operated in conjunction with a substation already planned at Lansdale. These stations will be supplied by the Reading Company from its main substation at Wayne Junction.

Wayne Junction will derive its power from the Conowingo hydro-generating station, on the Susquehanna River, and also from the Richmond and other Philadelphia Electric steam-generating stations. It will be supplied by 13,200-volt cables. In this station the 60-cycle current will be changed to 25 cycles, the form required for train operation. The initial size of this frequency-changing station will be 30,000 kw., provision being made for expansion to 90,000 kw., costing ultimately $4,500,000. The station will be equipped with a new outdoor type of frequency changer.

Work on 70 new multiple-unit cars, ordered April 1, has been begun by the Bethlehem Steel Company. The equipment consists of 61 passenger cars, seven combination passenger and baggage cars and two passenger, baggage and mail cars.

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Unprofitable Services Not Separable, Says Court

IN A decision handed down on May 19 the United States Supreme Court denied the right of the Broad River Power Company to suspend street car operation in Columbia, S. C. This ruling sustains an order of the South Caroline Supreme Court directing the power company and its subsidiary, the Columbia Railway, Gas & Electric Company, to resume operation of the service, abandoned in Columbia five years ago.

The opinion rendered by the Supreme Court held the corporate history of the company to be of paramount importance in determining whether or not operation of the service can be required. It was pointed out that none of the special legislative acts defining the privileges conferred upon the corporations contains any words affirmatively providing that any part of the privileges granted should be deemed separable, or that they might be exercised independently of any other.

It was also ruled that the contention

advanced by the company in regard to compelling a public service corporation to continue service at confiscatory rates does not apply. The order compelling the company to serve does not involve a determination of whether or not the rate is confiscatory. The written opinion states further that the order directing continuance of service does not foreclose appropriate proceedings for the determination of a proper return.

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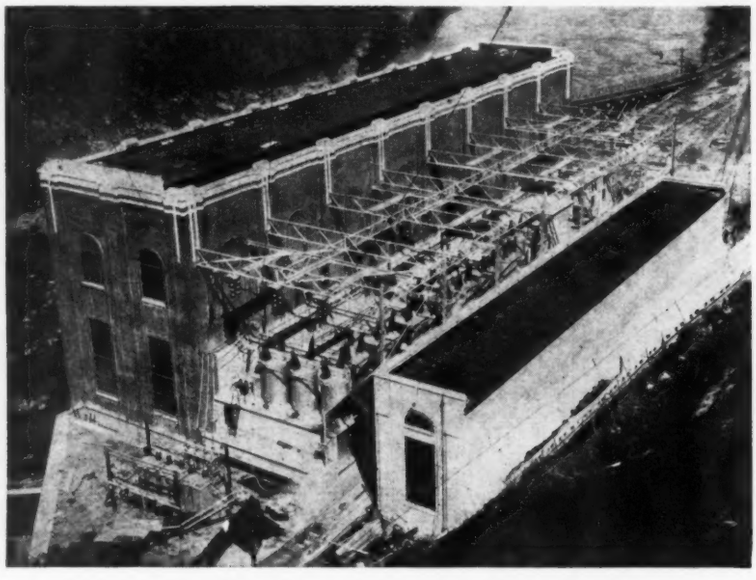
Aluminum Company Plant of 112,000 Hp. Starts Work

AFTER 2½ years of construction the new Calderwood hydro-electric plant of the Aluminum Company of America, located on the Little Tennessee River at Calderwood, Tenn., has been placed in operation under full load, thus rendering available for the manufacture of aluminum an additional 112,000 hp. in the company's Alcoa, Tenn., works.

The development comprises a dam 230 ft. high, a tunnel ½ mile in length and 26 ft. in diameter and a power house with two 56,000-hp. units operating under a head of 213 ft. Space is provided for the future installation of a third unit of like capacity.

This new plant is connected with the 154,000-volt transmission line of the Knoxville Power Company, already in service, carrying power from the Cheoah and Santeetlah developments to the reduction and fabrication works of the Aluminum Company at Alcoa. Aluminum is used throughout the plant for busbars and as a pigment in exterior and interior paint.



112,000-hp. private plant ties in with utility line

N. E. L. A. Convention Plans Approach Final Form

WHEN the National Electric Light Association meets in San Francisco next month for its 53rd convention there will probably be a registration of 4,000, or so present estimates would indicate. This will be by far the largest attendance of any N.E.L.A. meeting so far held on the Pacific Coast. June 16-20 is the date.

Business sessions are to consider many topics of importance to the industry at this time, including the effectiveness of state regulation, regulation of operating companies, government and business, rural electrification, the federal trade investigation, commercial prospects, load building, merchandising, the relation between steam and hydro power, radio and public utility development, international communications, relation of accounting to management and the various aspects of public relations.

Special features will involve telephone conversations to and from the World Power Conference in Berlin, the demonstration of the dispatch and receipt of a world greeting to be sent completely around the globe by land telegraph, submarine cable and wireless telegraphy, the finals of an employees' national public speaking contest and a commercial pageant.

Prominent speakers from within and without the industry scheduled

Among the noted individuals who have agreed to speak are: Robert P. Lamont, Secretary of Commerce; F. W. Sargent, president Chicago & Northwestern Railway Company; C. B. Allsopp, vice-president Postal Telegraph & Cable Company; Gerard Swope, president General Electric Company; B. F. Weadock, special counsel before Federal Trade Commission; William A. Prendergast, formerly chairman New York Public Service Commission; M. H. Aylesworth, president National Broadcasting Company; A. W. Robertson, chairman of the board Westinghouse Electric & Manufacturing Company; Edward N. Hurley, formerly of the United States Shipping Board and Federal Trade Commission; Martin J. Insull, president Middle West Utilities Company, and W. A. Jones, Cities Service Company.

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Ontario to Aid Farmers in Equipment Purchases

"AN ACT to provide for granting aid toward the installation of electrical works in rural power districts" is reported to have been passed by the eighteenth Ontario Legislature. The bill provides for a fund not to exceed $2,000,000 for the purpose of providing advances toward the installation of electrical services in rural power districts, including wiring from the transmission or distribution lines of the Hydro-Electric Power Commission of Ontario into and throughout dwellings, barns, outhouses and any other works which may from time to time be specified in regulations made under the authority of this act. Specific reference allows transformers, motors and such other appliances as may be necessary for any industrial, agricultural or domestic purposes or which may be specified in the regulations to be similarly provided for.

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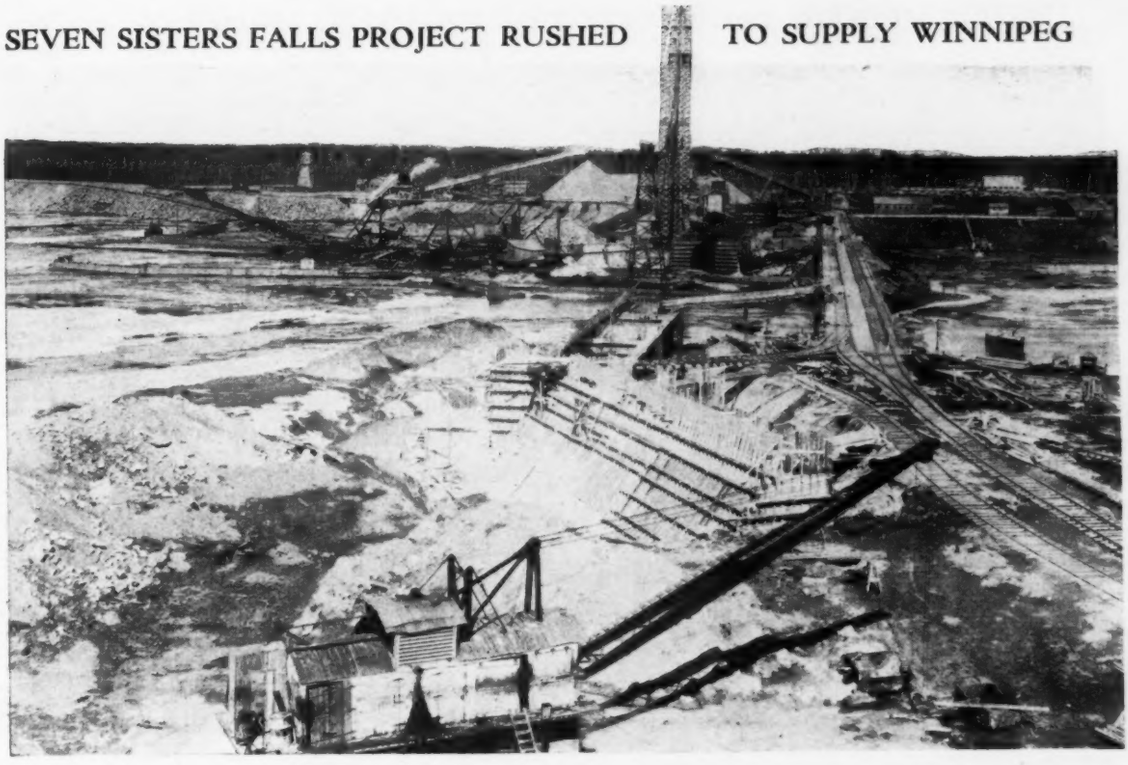
Potomac Parkway Plan May End Power Project

GEORGE WASHINGTON Memorial Parkway, assured by Congressional enactment and the provision of $9,000,000 for extending a park system from Mount Vernon to Great Falls on the Virginia side of the Potomac River, probably finishes the Great Falls power project.

Though strongly opposed by interests seeking to develop the river for power and navigation or to preserve it for that purpose, the enabling bill passed the Senate, having previously been approved in the House, without much debate and with no record vote. It is thought virtually to kill any possibility for private power development at the Great Falls site. The park development promises to be one of the most beautiful boulevards in the world.

SEVEN SISTERS FALLS PROJECT RUSHED TO SUPPLY WINNIPEG



With a claim for the lowest priced electricity on the continent and an average annual domestic consumption of 3,741 kw.-hr. per capita, Winnipeg, Canada, has expanded its use from 144,000,000 kw.-hr. in 1920 and 252,000,000 in 1925 to 703,000,000 in 1929 The third great hydro plant to supply the city, the Seven Sisters Falls project of the Northwestern Power Company, Ltd., will cost $20,000,000 and develop 225,000 hp. About 1,500 men will be employed there on construction work this year. The first units will probably operate by mid-1931

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Third Largest Hydro Plant in Canada for the Ottawa

AS NOW planned, the hydro-electric power project under way at Chats Falls, on the Ottawa River, about 35 miles above the city of Ottawa, will eventually be the third largest in Canada. The work is being administered by an executive board composed of four members, two from the Province of Quebec and two from the Province of Ontario, working under a joint agreement between the Hydro-Electric Power Commission of Ontario and the Chats Falls Power Company of Quebec. As the Ottawa is an interprovincial stream, it has been necessary to locate a portion of the power house on each side of the interprovincial boundary. For this reason the power house is at Mohr Chute, the largest of the various falls.

There will be eight turbine units, each rated at 28,000 hp., directly connected to 13,200-volt generators rated at 23,500 kva., and provision will also be made for the later installation of two more similar units, so that eventually a capacity of 280,000 hp. may be reached. In that event Chats Falls will be exceeded in size by only two other existing plants in Canada, namely, the Queenston development at Niagara Falls and the Isle Maligne development on the Saguenay River, in the Province of Quebec.

Dam to be 3 miles long with 72 sluiceways

The dam will have a length along the crest of 3 miles. The main portions follow more or less closely the crests of the various chutes forming Chats Falls. The greater part of the dam will be of gravity non-overflow section, but at various places sluiceways will be placed to discharge flood waters during the periods of high river flow. In all, 72 sluiceways will be provided. Their discharging capacity will be greater than any known flood on the river.

There will be four sluiceways, closed by steel gates 40 ft. wide, close to the power house, to effect quick and accurate regulation of the river levels and flow. All of the fall between Chats Lake and the power house site, 3 miles downstream, will be concentrated at the power house, and in place of the present rapid section of the river there will be an unbroken reach with moderate velocity, except during floods.

New Hampshire to Probe Associated Gas & Electric

INVESTIGATION of the Associated Gas & Electric Company will be undertaken by the Public Service Commission of New Hampshire, according to recent reports. Officials of the public utility company have been ordered to appear before the commissioners on June 3 with all available information relative to the capitalization, franchises and the manner in which its properties are managed and operated.

The concern controls the New Hampshire Gas & Electric Company and the Derry Electric Company. At the same time State Insurance Commissioner John E. Sullivan suspended from sale in New Hampshire the 5 per cent $20,000,000 convertible debenture bonds of the New England Gas & Electric Association doing business in the state. He also revoked the dealers' licenses of the Associated Gas Company and the licenses of its salesmen.

Banking and investment houses that have sold any of the issue have been ordered to cancel the sales and refund any money paid by New Hampshire residents.

MOSCOW CELEBRATES MAY DAY WITH LIGHT!

Red Russia must have been fairly peaceful and somewhat familiar to even a "capitalistic" eye on May Day this year—possibly reminiscent of Light's Golden Jubilee—for many public buildings in Moscow were gayly arrayed with thousands of colored electric lamps, while the populace paraded through the streets on the workers' traditional day for trouble

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Commission Rule Urged by Civic Heads in Texas

AT THE annual convention of the League of Texas Municipalities, held in Austin and attended by mayors, city managers and city attorneys of more than one hundred cities, regulation of public utilities became the keynote. It was the expressed sense of the meeting that the question of enacting a law creating a State public utilities commission should be made an issue of the present campaign for Governor.

A plea for a fuller and freer discussion and more co-operation between the public utilities and the communities they serve in order to effect a proper solution of their common problems was made by J. A. Worsham of Dallas, general counsel of the Texas Power & Light Company.

"There can be no real conflict between the best interests of the utility companies and the best interests of their patrons," Mr. Worsham said. "Maximum service at a minimum cost is the basis of operation of the public-spirited utility men of today."

It was Mr. Worsham's contention that the public utility companies of Texas are not opposed to regulation, either state or local, but are opposed to a dual system of regulation.

"Competition in public utility service is destructive of the best interest of the public, whether such competition is between privately owned utilities or a privately owned utility and a municipal plant," he said.

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Albany Service Building to Be Fully Welded

NOT only will the framework and roof trusses be welded in the new service building being erected by the New York Power & Light Corporation in Albany, but the roof itself and all the steam piping over 2 in. in diameter will be installed by that method. The new building will be 375 ft. long and 198 ft. wide, partly single-story and partly multi-story in design.

About 700 tons of steel will be involved in the structure. It is estimated, in addition to many other advantages, that about 30 tons of steel will be saved by using the welding method. One of the novelties in the construction of the building will be the installation of an all-steel roof of the steel-deck type, completely welded. Sections of shaped steel resembling corrugated forms will be welded in interlocked positions and covered with roofing material.

Utility Investigations Begun by South Carolina

THE Railroad Commission of South Carolina is proceeding under direction of an act passed at the recent session of the Legislature to obtain from the operating electric utilities of the state copies of all contracts in force for sale of current and further information as to their "business affairs," in order to arrive at a full understanding of the electric situation in the state in all of its relations. This is said to be the outcome of the pressure brought to bear upon the legislative body by the South Carolina Power Consumers Association, organized to bring about a reduction of the rate schedules over the state.

Meantime, under a resolution passed at the same session, the commission has taken under its consideration a proposal to institute a state-wide survey to determine the practicability of development of rural electrification under the control and by subsidy of the state. The establishment of distribution lines on the rights-of-way of the system of permanent highways, for which a $65,000,000 bond issue provides, is considered. This will, it is said, affect several thousand miles of highways over all parts of the state.

Coming Meetings

National Electrical Wholesalers' Association — Hot Springs, Va., May 26-30. E. Donald Tolles, 165 Broadway, New York.

American Electrochemical Society — St. Louis, May 29-31. C. G. Fink, Columbia University, New York.

North Central Division, N.E.L.A.— Managerial Section, Alex. Johnson Hotel, Rapid City, S. D., June 11-12. J. W. Lapham, 803 Plymouth Bldg., Minneapolis.

Canadian Electrical Association — Manor Richelieu, Murray Bay, Que., June 11-13. H. M. Lyster, 405 Power Bldg., Montreal.

Pacific Coast Division, N.E.L.A.— San Francisco, June 16. S. H. Taylor, 447 Sutter St., San Francisco.

National Electric Light Association— San Francisco, June 16-20. A. J. Marshall, 420 Lexington Avenue, New York.

Association of Iron and Steel Electrical Engineers — Broadway Auditorium, Buffalo, N. Y., June 16-20. John F. Kelly, Empire Building, Pittsburgh, Pa.

World Power Conference—Berlin, Germany, June 16-25. O. C. Merrill, Edmonds Building, Washington, D. C.

Wisconsin Utilities Association — Accounting Section, Eau Claire, June 19 and 20; Electric Section, Lorain Hotel, Madison, July 17 and 18. Commercial Section, Green Bay, July 31 and August 1. J. N. Cadby, 105 Wells St., Milwaukee.

American Electric Railway Association —San Francisco, June 21-26. Guy C. Hecker, 292 Madison Ave., New York.

American Institute of Electrical Engineers—Summer convention, Toronto, June 23-27, F. L. Hutchinson, 33 West 39th St., New York.

American Society for Testing Materials —Haddon Hall, Atlantic City, N. J., June 23-27. C. L. Warwick, 1315 Spruce St., Philadelphia.

Camp Co-operation X — Association Island, Henderson Harbor, N. Y. August 8-12. Society for Electrical Development, 420 Lexington Ave., New York.

Association of Electragists International—Hotel Schroeder, Milwaukee, August 18-20. L. W. Davis, 420 Lexington Ave., New York.

International Association of Electrical Inspectors—Northwest Section, Bellingham, Wash., Aug. 25-27. F. D. Weber, 414 Lumbermen's Bldg., Portland, Ore.

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N.E.L.A. and N.E.M.A. Agree on Voltages

PREFERRED voltage ratings for alternating-current systems have been agreed upon by a joint committee of the National Electrical Manufacturers' Association and the National Electric Light Association, A. L. Harding chairman.

The ratings are given in a series of tables published in the joint committee report, recently released. The preferred voltage ratings cover generators, motors, distribution transformers, substation transformers, transformers for use with generators for supplying higher voltage systems, transformers for reversible tie purposes, and general apparatus such as disconnecting switches, fuses, oil circuit breakers, etc.

Rural Service Pays, Puget Sound Company Finds

"MAKING service available to the farmers of western Washington has resulted in a remarkable increase in the annual net income of the farmer, the Puget Sound Power & Light Company has benefited from the community development and, in addition, the utility is earning a fair return on its investment in the rural business," says A. W. Leonard, president of the company.

Approximately $4,133,000 has been spent since 1922 in building 4,133 miles of rural lines to serve 52,093 customers. The rural electric service department has developed many new electrical devices for use on the farm and, according to Mr. Leonard, farm customers show an average consumption of 1,502-kw.-hr. per year, with an average annual revenue of $49.92, making the average rate 3.32 cents per kilowatt-hour.

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AUTOMATIC WELDING SIMPLIFIED

Although not new, automatic welding equipment is being continually improved and made less cumbersome. The operator in charge of the fabrication of this boiler is only needed to start and stop the machine. A temperature of 6,400 deg. F. is attained "Weldomatic" is the name used by the Westinghouse Electric & Manufacturing Company

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425-Ft. Towers Permitted for Mississippi Crossing

PERMISSION to erect two 425-ft. river crossing towers has recently been granted the Baton Rouge Electric Company by the federal government. They will be part of a 66-kv. transmission line over the Mississippi River at Baton Rouge, La., under construction, and now nearing completion, by the Stone & Webster Engineering Corporation. The towers, according to government representatives, are the tallest river crossing towers in this country. The line will transmit power from the new Louisiana station of Louisiana Steam Products, Inc., a constituent company of Engineers Public Service Company, across the river to the existing system of the Baton Rouge Electric Company and also to the Gulf States Utilities Company.

The permit was granted with the provision that the wires clear high water at a minimum height of 150 ft. and that the towers be painted black and white and also be brightly illuminated to avoid hazards to aviation.

SNOW MELTS TO POWER IN SWITZERLAND

THIS 50,000-volt switching unit, located at a future power station site, handles part of the hydro-electric energy generated from the 54,000,000-gal. run-off of the Aar in the Alps. One of three hydro sites, whose total capacity of 240,000 kw. is expected to yield half a billion kw.-hr. annually, has been completed in this district.

EDITORIALS

L.W.W. MORROW
Editor

Federal Power Commission a New Bureau?

THE Couzens bill providing for a reorganization of the Federal Power Commission has passed the Senate and promises to be acceptable to the House, in the opinion of administrative leaders. The bill provides for an independent commission of three men on full time with an independent staff. In other words, it establishes another government bureau and introduces radical changes in the Power Commission organization.

It does not appear that the effect on the electrical industry will be very great if the Couzens bill is approved. But it does have undesirable provisions from an administrative and public interest point of view. Water power is a comparatively small factor in power development, yet it rates a government bureau that will be built up inevitably into a large and expensive group as the years elapse. The proposed independent bureau is certain to introduce conflicts with other government departments having jurisdiction over navigable streams and public lands and it has no increased power to deal with the state authorities on conflicting claims as to federal and state jurisdiction over water powers. The new bureau means increased delay and expense and increased participation of politics in commission activities.

Centralization of authority in one full-time commissioner, a small addition to the commission staff and the continued utilization of the staffs of other government departments appears to be the logical initial step to take in Federal Power Commission reorganization. But if Congress thinks it wise to pass the Couzens bill, despite its faults, the electrical industry will continue to exist and will try to co-operate with the new commission to the best of its ability.

Incremental Equipment for Peak Loads

ELECTRICAL engineers now realize that there are savings possible through the use of special equipment to carry peak load and are giving consideration to the various methods by which this can be accomplished. The central station must have sufficient capacity installed to carry the maximum peak loads. These maximum peaks last for only a few hundred hours a year. It has been frequently pointed out that the predominating element in the cost of plant to carry such peak loads is the fixed charges. Because of the short duration of the peaks fuel economy is a secondary consideration of much less importance. Hence, even with indifferent economy, peak-load plant should be low-cost plant.

Usually the older equipment on a system is employed to carry peak loads, and this is quite proper provided that no cheaper plant is available. Frequently this old plant is suitable only to carry small loads, and its standby charges, both to keep up steam and to provide for necessary labor, are high. When a suggestion is made that special plant may be provided to carry peak loads in the most economical way, attention is called to the growth of load, which is often such that a December peak for one year is the ordinary peak of the next summer. Even so, it may still be economical to provide special equipment for peak loads only and to care for system increases by additional base-load equipment.

Various writers have discussed the advantages for use on peak loads of Diesel engines; hydraulic storage and steam storage by means of accumulators, and the possibilities of each system are now quite generally recognized; but the ideal plant for peak load would be one differing as little

as possible from the standard plant. Such equipment now appears to be available for central stations. In fact, it is already in operation. Steam turbines are purchased with primary, secondary and tertiary valves so that by-passing of the high-pressure section enables the unit to carry loads of 60 to 100 per cent greater capacity than its most economical rating. Condensers are designed for most economical load and vacuum will fall on overload. Since this excess capacity need only be used for carrying peak loads, the loss of economy is insignificant. Generators are built for maximum capacity. Boilers are provided with large furnaces. Fuel-burning and draft equipment is designed to provide steam for full load on the turbines when needed on peak load.

These designs call only for incremental additions to costs of turbines, generators, boiler and coal-burning plant. The cost of such added capacity should be small. This high-capacity plant is not materially different from the standard station. Finally, the extra capacity of these units above most economical load is available at all times for instantaneous service in emergencies. The plan has many features to commend it for low-cost peak-load service.

Wood Construction in Favor

STYLE changes occur in engineering, and the latest is a revival in the use of wood structures. This has come about largely through a study of insulation values and the recognition that protection against lightning is an important item in design. At several engineering meetings lately field data have been submitted to show that transmission reliability on lines of moderate voltage can be improved by the use of wood. The extreme of this principle is to use wood pins, wood crossarms and wood braces on wood poles and to space conductors for maximum clearances.

Undoubtedly the insulation values of wood can be used to advantage, but a properly designed transmission line is a combination mechanical, electrical and economic design. Wood does not lend itself to precision calculations, it decays and has certain strength limitations. The use of wood can be overdone, but undoubtedly wood pole lines have a place in transmission to a greater degree than that attained in past years. Very complete study must be had, however, for each local condition before it can be said the use of wood pins and braces is economical or advisable. The use of the ground wire on wood pole lines is also debatable so far as field data give conclusive evidence. The method of installation and the character of the grounds that are maintained are governing factors in the use of ground wires. On the whole, the renewed interest in wood structures is encouraging and promises better service and savings in investments.

Cash Bonuses to Stimulate Sustained Zeal

COMMISSIONS frequently are liberal to a utility in a rate decision because the company has been notably successful in building its load and its favor with the public. It seems that this principle of reward could well be carried one step further into the utility organization. Why not reward the individuals primarily responsible for progress, not alone by an increase in salary or an advancement in rank, but by open award of bonuses, in cash as well as in stock? Stock awards have their merit, but their value hinges on the sustained efforts of other individuals than the one who at the moment earned his reward.

The time may not be ripe for full publicity on utility salaries, but business generally seems to be on the verge of more internal publicity on these points, and the utility industry may ultimately be drawn into the practice. At the present time the commissions only in isolated cases refer to specific salaries; the Federal Trade Commission in its inquiry has scrupulously avoided quizzing on detailed figures. But the tendency toward critical analysis of the relative importance of men, money and materials in making or breaking an industry may lead to the adoption of new methods of increasing the yield from the investment in personnel. At least, J. P. Jordan, in addressing the American Management Association, took this stand, doubting whether the majority of men in executive or semi-executive positions "render as much as 50 per cent yield of their possible effec-

tiveness." This may apply singularly to the executives and department heads of companies recently involved in absorptions, who, despite their devotion to the industry, may suffer somewhat when the "little frog in the big puddle" atmosphere interferes with their breathing.

Centralized authority entails, during a transition period, a division and uncertainty of responsibility on the part of those in the surface ranks. Maybe the way to shorten this period is to stimulate an invigorated interest in teamwork by resort to immediate reward for unremitted vigor.

Overlooking Direction of Light Offsets Increase of Intensity

ENGINEERS who have fought for better illumination may well be appalled at some things done in the name of a good cause. Because many installations of the past have been woefully deficient in the matter of sufficient intensity and uniformity of illumination, these factors have been rightfully emphasized a great deal. But, unfortunately, concentration of attention on them has apparently obscured equally important factors like proper light direction and shielding of light sources. Without these provisions higher intensities may be of little value and even objectionable, as any one will testify who must work with light sources or sharp reflections off nearby surfaces continually in the range of vision. Furthermore, merely providing a vertical component of sufficient intensity does not solve the problem of illuminating working surfaces that can only be lighted by a horizontal component.

"Here is something that will interest you," said the factory engineer-superintendent to an itinerant editor of the ELECTRICAL WORLD. "We have just completed a full rebuilding of our lighting system in this mill. We have thus-and-so-many foot-candles. We have painted our walls with aluminum paint to distribute the light. We have put in heavier copper to reduce voltage drop. We have arranged for control where needed."

"Yes, it appears to be a fine job," conceded the editor. "Would you mind turning on the lights in this bay so that I may get the effect?" The mill floor and machines were drenched in a heartening glow. But the light sources just under the low-level crane rails shot their rays directly into the visitor's eyes. For a moment the editor thought himself on a stage. It was as though footlights and a spotlight or two had been focused upon him. As long as he kept his eyes vertical all was well, but upon raising the eyes an annoying and distracting glare from the light sources was experienced.

"What effect will this glare have on the efficiency of the workmen?" the editor asked. "Well, we can't have everything" commented the superintendent, somewhat wistfully, "the crane is so low. We did the best we could. Of course, we could have installed sources of higher intensity on closer spacings above the crane, but that would have required a lot more electricity and copper." "Well," ventured the editor, "suppose it had? Did any one try to balance the advantages against the costs?" "No, it's good enough," the superintendent said. "You should have seen it before."

Radio Suit May Bring Relief

THE government has filed suit against the radio group that has been a center of news interest recently. Again the old questions of monopoly, patent pooling, price fixing and conspiracy are to be aired in the courts. In the radio industry competition and chaos existed until thoughtful business men attempted to get some order and control. This involved mergers, agreements and combinations that culminated in a large business enterprise. Hence the usual procedure of the government is to question the legality of the proceedings and of the enterprise.

It is a healthy condition to find this suit instituted. A public airing of big and reputable business enterprise will do good. If the enterprise is sound and constructive no injury will be done it, or if injury is done, because of antiquated or inadequate laws, the laws will be changed. It is high time that the country and Congress should know about these enterprises so that legislative responsibilities can be placed and a new philosophy established with respect to big business.

Ground-Fault Relaying with Metal-Inclosed Buses

By S. M. DEAN* and W. F. WETMORE

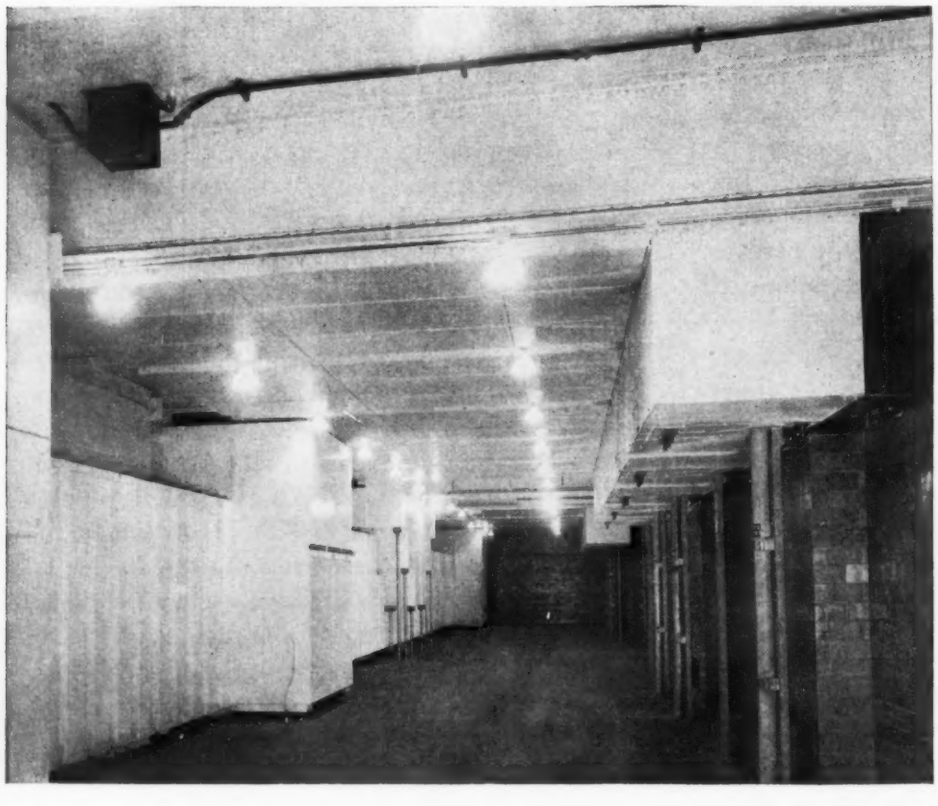
Engineering Division, Detroit Edison Company, Detroit, Mich.

AN EXTENSION of the Waterman substation of the Detroit Edison Company, recently placed in service, embodies several rather novel features. Briefly, the design is such as to constitute an air-insulated, metal-inclosed type of switchgear with ground fault relaying. The station acts as a switch house for the Delray power houses, located at a distance of approximately 2,000 ft., and the generator feeds, three at present, enter the station by underground cable at 24,000 volts. Each generator is connected to its corresponding feeder buses, and also to a synchronizing or "equalizer" bus, through reactors. This arrangement results in the conventional star system of connections.

The old bus section of the station was of the solid ring type—that is, with no reactors—and the extension consists not only of an increased number of feeder and generator positions but also of the equalizer bus and reactors for the entire station. As the capacity of the switches in the old section was considered inadequate for the expected duty, the necessary changes were made to accommodate the General Electric type FH-209-C switches used in the extension.

Experience has shown that the use of reinforced concrete for bus and switch housings is rather unsatisfactory in the event of a line-to-ground fault within the switch house. The path of the ground current is indeterminate and, at points of light contact between reinforcing rods, concrete may chip out and cause a secondary failure at a considerable distance from the original fault. The use of metal provides a very definite path for ground current and eliminates the possibility of such a condition. As compared to an oil- or compound-filled bus structure a faulted section of the air-insulated, metal-clad structure can be very quickly restored to

*Senior Engineer.



Main bus housing

At the left are main bus and potential transformer housings. Cable pothead inclosures are on the right. On the ceiling, left center, is one of the fault current transformers in a ground connection.

PROTECTED buses and switchgear are rapidly increasing in importance as a factor contributing to that modern ideal of electric service—continuity—as well as to the no less important ideal of safety. However, none of the methods of protection so far developed can yet, because of wide application, be characterized as "usual," but if any had yet earned that term the one described in this article might in distinction from it be labeled "unusual." Here no oils, greases or other minerals are used for insulation between conductors and inclosures; just air. Special equipments and fixtures are not largely necessary in this method of protection and its installation is only little different from commonly existing bus construction practice.

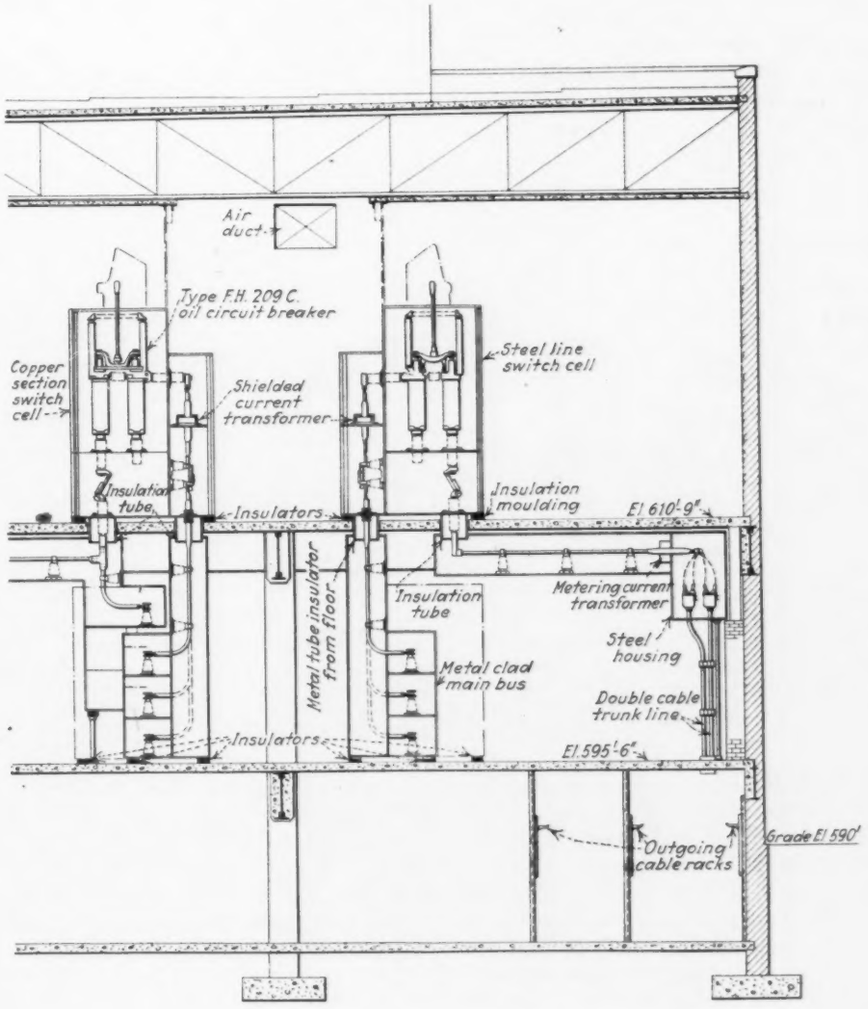
service after visual inspection, and this is very important on a system which does not employ duplicate buses or switchgear.

Another advantage of the metal design is that the construction of the building walls, floors, partitions, fireproofing, etc., can be completed and the building construction force largely removed from the job before the housings for the electrical equipment are installed. All housings for this station, except those for the reactors, were made in the company's metal shop and trucked to the station as required.

The principle of design

The basic principle of the design is the complete inclosure of each phase conductor in a ground metal housing. In other words, there should be no fault possible other than line to ground. This has been accomplished in all cases, except at bus potential transformers and outgoing cable potheads. The potential transformers are protected by fuses and resistors mounted in separate phase compartments so that a failure of the transformers can result in only a minor fault cleared normally by the fuses. The possible subsequent failure of a fuse, of course, constitutes a line-to-ground bus fault and is treated accordingly. The cable potheads are mounted in a metal housing grounded separately from the bus and switch housings so that a failure at such a point is relayed as a cable fault.

With these exceptions, all equipment such as main buses, oil circuit breakers, bus taps, connection runs, reactors and current transformers are housed in such a manner that each phase is completely surrounded by grounded metal. The bus and high current connections are housed in copper with the necessary bracing to carry the insulator stresses and to reinforce the structure against gas pressures generated by a fault. All angles

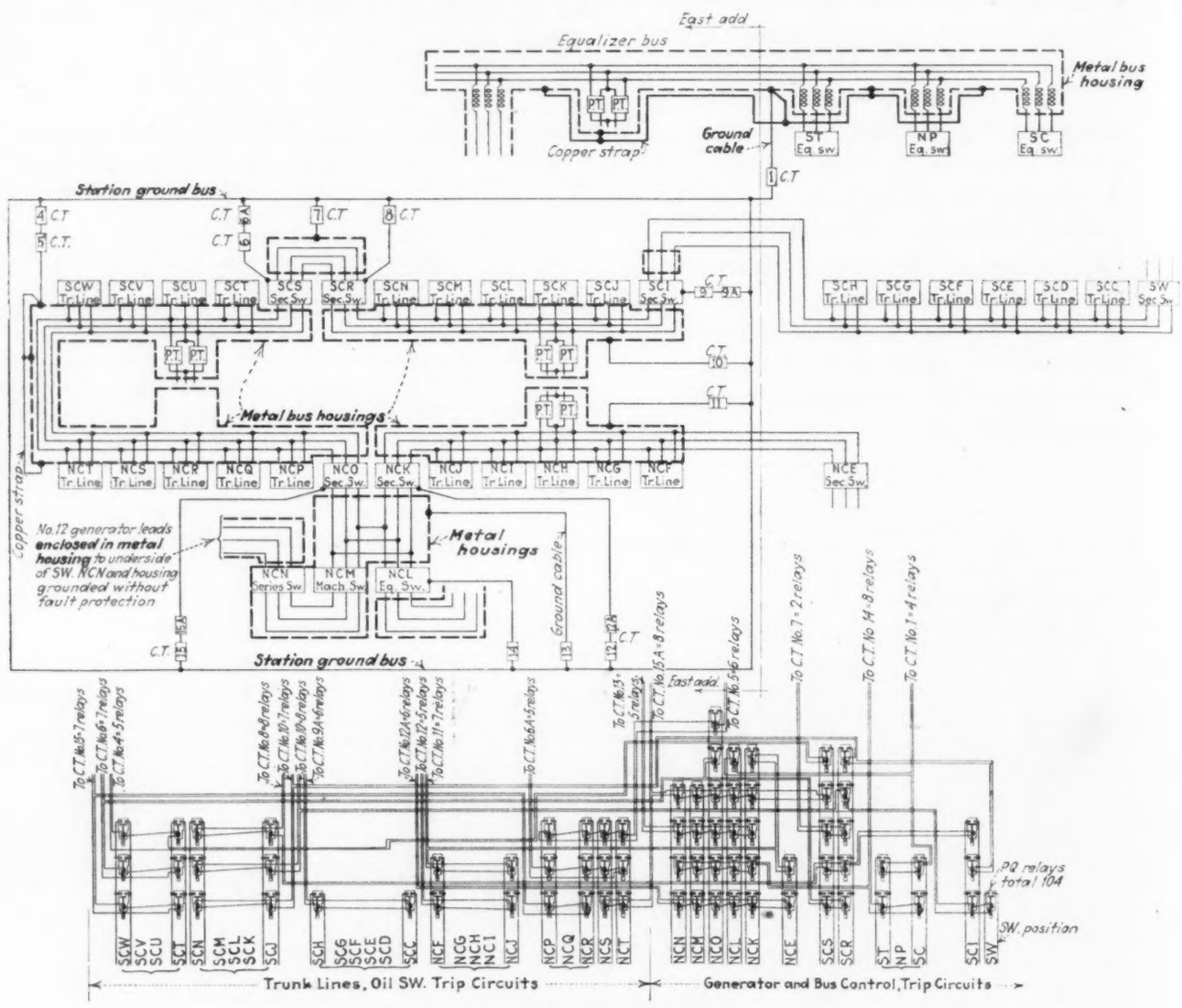


Section of sheet metal inclosures

Bus runs, switches, etc., are in separate inclosures, insulated from each other and from ground except at connection points through which fault current must flow. Steel sheets and structural members are used except in proximity to heavy current conductors, where copper and bronze are substituted.

inside of the housing are of bronze, whereas those on the outside are of steel, as they are shielded sufficiently to avoid heating. The housings for low-current runs are of the same design except that steel is used throughout.

By insulating the various structures from the building and grounding only at definite points through current transformers it has been possible to set up an effective system of ground fault relaying. All line switch housings of a given section are connected directly to the bus will operate the necessary relays to open all line switches on that section and the adjacent section switches, thereby removing all possible feeds to the fault. Instantaneous relays are employed to reduce the time to a minimum. In the event of a section switch fault, all switches on the two adjacent bus sections will open; that is, the feeder section on one side and either the generator stub bus or a feeder section on the other, depending upon the switch in question. The same method is carried through for the other units of the station so that a fault


East add
Equalizer bus
Metal bus housing
Copper strap
Ground cable
ST Eq. sw
NP Eq. sw
SC Eq. sw
Station ground bus
Metal bus housings
Copper strap
No.12 generator leads enclosed in metal housing to underside of SW. NCN and housing grounded without fault protection
Metal housings
Ground cable
Station ground bus
East add
To C.T. No 7 - 2 relays
To C.T. No 14 - 8 relays
To C.T. No 1 - 4 relays
PQ relays total 104
SW. position
Trunk Lines, Oil SW. Trip Circuits
Generator and Bus Control, Trip Circuits

Fault-bus relay scheme

The upper part of the drawing shows two generator positions (one occupied and the other connected through), three bus sections inside the station ground bus rectangle and outside it portions of the equalizer bus and of adjacent bus sections. Current transformers, identified by numbers, are connected by correspondingly numbered leads to the relays at the bottom. The switches controlled by the relays are identified by letters.

housing of the corresponding section of bus and the complete unit grounded through a current transformer. Each section switch housing is grounded through an individual current transformer, as are also other separate units such as the housings for generator stub buses, equalizer switches and the equalizer bus. The generator switch housings are tied to and form a part of their corresponding stub bus housings.

With this arrangement a fault in a line switch or its at any point will open instantaneously all of, but not more than, the necessary switches to clear the fault.

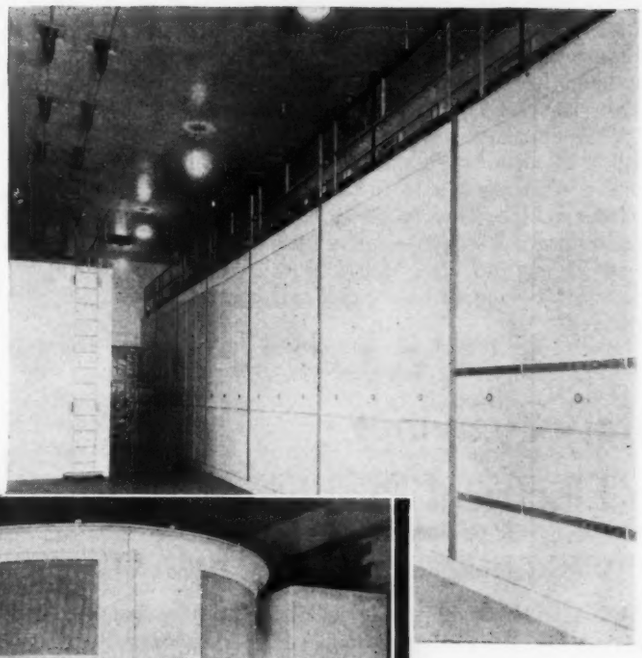
In order to be assured that no fault current can get to ground by other than the proper paths, an ample factor of safety was used in the insulation of the various structures from the building. The bus and switch housings were set on small porcelain insulators and a minimum of 2-in. air clearance or creepage over insulating material was maintained. The insulators are plainly visible

under the reactor and connection housings, shown in one of the accompanying illustrations.

All housings were tested to 10,000 volts, with the permanent ground connections removed to bring out any points of faulty construction. Subsequent tests at 5,000 volts will be made periodically. It is felt that any accidental contact from housing to ground which might exist during the daily operation of the station will have such a high impedance as compared with the permanent ground connections that the bypass current can be of only very minor importance.

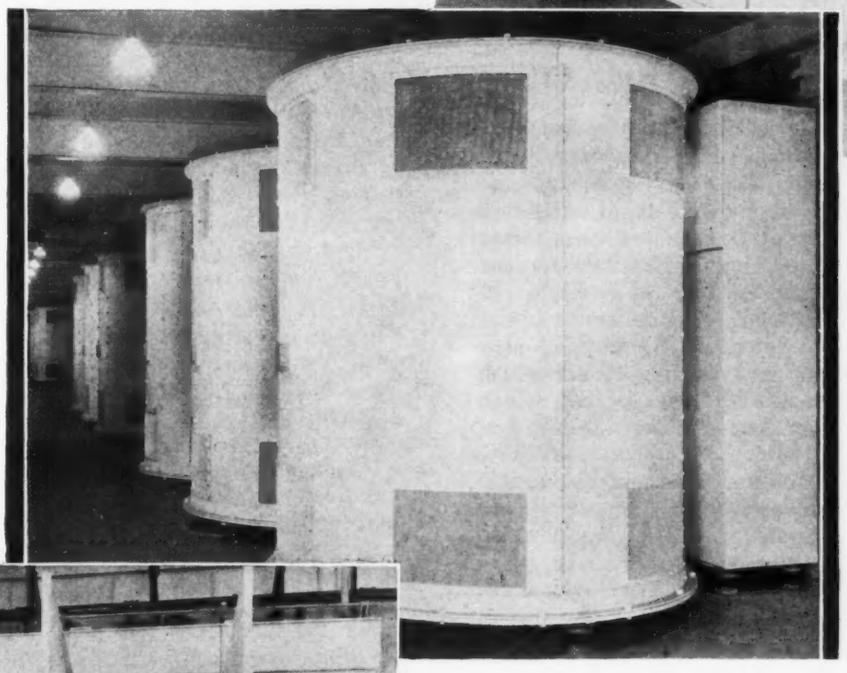
There has been one fault in the station since it was placed in commission and the operation of the system was correct and highly satisfactory. After testing a line switch a test lead was accidentally left in the cell and the switch reported clear. When the operator closed the bus disconnects there was an immediate short circuit to ground. The necessary breakers opened automatically and the resultant damage was very slight.

The station is divided by barrier walls in such a manner that a separate room is provided for each section of feeder switches. All rooms have windows to the outside



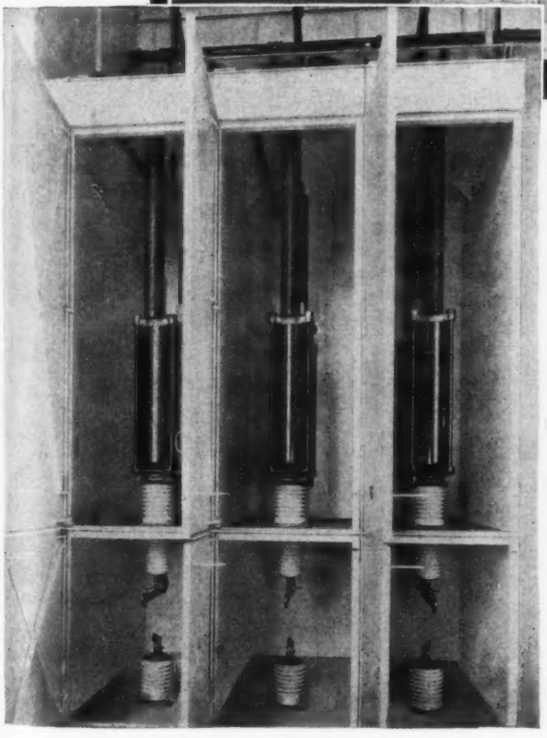
Switch inclosures

A line of feeder and section switch cells is on the right. On the left, are cells for switches to equalizer bus.



Metal inclosures house these reactors and equalizer bus

The housings on these 2,500-kva. units are the only ones not locally manufactured. Below the inclosures may be seen pedestal insulators that make a ground fault bus of the housings.



Oil circuit breaker elements inclosed in metal compartments

The 600-amp. line oil circuit breaker cells are constructed of steel plate with welded joints and a very small amount of bracing to give the necessary rigidity. The 3,000-amp. breakers used as section, generator and equalizer switches are housed in the same type of housing except that copper plate and bronze angles are used where required to avoid heating. The oil switch and disconnecting switch cell doors are hinged and interlocked with the breaker mechanism. Close clearances are maintained at the door edges and a simple labyrinth type of seat is provided to impede the entrance of smoke and gas that may exist outside of the cell due to trouble in other equipment.

of the building for light and to act as explosion vents. Heating is of the recirculating hot air type, but arrangements are made to close the air return to the fans, open an exhaust to the outside and supply fresh air to the fans for the purpose of clearing smoke out of the building in the event of a fire. Double-speed fan motors are provided to allow high-speed operation under such conditions. With such a station design it is expected that any fault will be line to ground, the duration of fault will not exceed 15 cycles and the trouble will be limited to a single section. In case of an oil fire the smoke will be confined to one section room and be removed rapidly by the fans.

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Safety Activities on Electrical Properties*

V—Selection and Training of Employees

NUMEROUS studies have disclosed the fact that employees are most susceptible to accidents during the first year of employment. Lack of familiarity with surroundings and the work assigned to them, immature judgment and the tendency to take "short cuts" often lead to accidents, as well as to unsatisfactory service. Accordingly, many organizations find it profitable to provide a systematic program of selection and training for all new employees. To determine the physical condition of new employees and the type of work for which they are best suited, fifteen of the companies which co-operated in this study subject applicants to physical examinations.

On some properties the foremen are held responsible for the adequate instruction of new workers, or an experienced employee is delegated for the purpose. On others the duty is assigned to representatives of the safety department, engineers of casualty insurance companies or representatives of agencies with whom arrangements have been made for performing this work. Several companies have also adopted the follow-up plan to determine whether satisfactory progress is being made.

*See ELECTRICAL WORLD, *April 26, May 3, 10 and 17.*

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Machine Back-Filling and Tamping Pays

By R. J. DRAKE
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Public Service Company of Northern Illinois, Chicago, Ill.

MUCH labor-saving machinery was employed in the installation of an extensive street-lighting system in a suburb of Chicago. Back-filling and tamping were performed by machines at a much faster rate than could be done by hand labor. For back-filling the contractor mounted a horizontal extension frame on the back of a Fordson tractor. At the point of this frame was placed a pulley through which was threaded a cable going to a winch connected with the power take-off on the tractor. The other end of the cable was carried out to a flat board scoop fitted with guide handles. Two men operating this equipment, shown in the accompanying illustration, back-filled 6,000 ft. of trench in eight hours. A laborer with a shovel would back-fill about 600 ft. in the same time. Two men with the aid of the tractor and auxiliary equipment, costing only $300, were able to do the work of ten.

Tamping back-fill appears to be one of those jobs, like painting miniatures, that must always be done by hand, but even in this exclusively manual art the contractor was able to introduce machinery, and in a very simple manner, too. A small caterpillar tractor was run up and down the street with one track in the trench and the other in the gutter. The weight of the tractor was sufficient to tamp down the back-filling satisfactorily and a day's work for the machine was about 24,000 ft. of trench.

Tractor back-filler does the work of ten men

SAMUEL INSULL Reminisces*

Early days in management and finance. Start of Commonwealth Edison and Middle West Utilities. Human values in utility success

IT IS a good far cry from 1892, May, 1892, to May, 1930, 38 years. I came to this city in the spring of 1892. I had been engaged in the electric manufacturing business in the East under the auspices of the various companies with which Mr. Edison, personally, and his name were associated, but owing to a consolidation, somewhat rare in those early days, I found myself demoted practically from the top to the bottom, and I thought it was about time that I looked further afield than New York City for something to do. So I took Horace Greeley's advice and looked west.

And I had in mind that in the various visits I had made here to Chicago during the previous ten years to that date, on some of which I had the pleasure and honor of being accompanied by Mr. Edison, after we had driven around the city more or less, he always would turn to me and say, "Sammy, this is one of the best centers in the country for our line of business." So, remembering that some of my friends in the old Chicago Edison Company had a year or so prior to '92 asked me to find a president for them, I wrote to my friend Edward L. Brewster and at the same time to my friend Byron L. Smith and nominated myself for that position.

The company had been organized in 1887. I became its president in May, the first of May, 1892, and assumed regular management in July of that year. I had my experiences of financing as a young man in the electric manufacturing business, and I had about made up my mind, after hearing that a very distinguished New York financier of German antecedents had remarked, "Yes, I know that young man Insull. He can spend ten millions of dollars quicker than any man I know"—I made up my mind that I did not want any further connection with financing; so I stipulated when I came to Chicago that I should operate the property, and that the board of directors should do the financing.

It was a small institution. I think it had about $833,000 invested when I accepted the presidency. On my advice the company put another $250,000 into its treasury through its stockholders, just a few weeks before I took up my existence in Chicago in July, 1892. It had a small central-station business downtown and a few houses lighted on the south side. The company grew apace. I did not want to be involved in the financing, but I found myself, in the panic of 1893, having a demand made on me by the same gentleman who negotiated with me to come here, who was then president of the leading banks, asking me to pay, the next day, a call loan of $400,000.

So I found myself back on the financial side, and right in the panic of 1893 we had to go to our stockholders again and ask them to provide us with the money to clear up our bank indebtedness.

To give an idea of the growth, in the intervening 38 years, the group of properties of which the Commonwealth Edison Company, the successor of the old Chicago Edison Company, is the senior company, represent a total investment of the public's money of upward of $2,000,600,000, with a market value of about $3,000,200,000. Those companies have a gross revenue of upward of $500,000,000. They have upward of 600,000 stockholders, to say nothing of probably a similar number of individuals who are bond owners.

To protect this vast investment and to provide for the growth of the business and the refinancing, our group sold last year to the public five hundred and fifty millions of securities, and during the first three months of this year have sold to the public upward of one hundred and sixty millions of securities.

Early financial experiences

But let me get back to the early years. We had no such figures in the early years, but it was infinitely more interesting. The struggle was greater. We had little or no support from the bankers or stock brokers or the investing public.

One of the worst experiences I ever had was during the Bryan silver campaign of 1896. The old Chicago Edison Company had another of its inconvenient call loans at the bank and it was for the same amount, $400,000. I vowed if I could ever get that clear I would never have a call loan of $400,000 again. It might be double or half that amount, but it never should be $400,000.

We had made arrangements with an investing trust in London to take $1,200,000 worth of our bonds. Then came the Democratic convention. Mr. Bryan delivered his Cross of Gold speech and our chances of selling $1,200,000 worth of bonds in London went glimmering.

I remember at one board meeting when we were discussing the possibilities. The bonds were sold first, subject to examination. The examination had been made, but I think that speech of William Jennings Bryan, delivered at the Democratic convention, delayed in some mysterious way the delivery of these reports of the experts who had been looking into our property.

**Abstract of address by Samuel Insull at the annual banquet of the Chicago Stock Exchange, Chicago, May 12, 1930.*

One morning my friend Byron L. Smith asked me whether I could go to London and see what I could do about getting that money. I said, "Yes, I can go." He said, "You ought to go tomorrow." I think that was Wednesday. I said, "I will take Saturday's steamer and go over as quickly as I can and see what I can do." I said, "I don't think I can deal with those people very well." I was pretty young, and while having a full appreciation, as most young men have, of their capabilities, I still pictured myself appearing before the board of directors of the London Trust Company and those men looking at me and saying, "Well, he is pretty youthful to follow, especially during a silver campaign."

Well, I got over to London. Fortunately, the chairman of the company we were dealing with had known me when I was an office boy in London. Before I got through with him I persuaded him that he knew me very well, indeed. He happened to notice the name of Isham on the letterhead of one of our lawyer's letters that I submitted to him. He said, "Is that my friend Edward S. Isham, whom I take baths with every year?" He was quite stout himself, and some of you older people will remember Mr. Isham's qualifications in that direction. I said, "I think so." He said, "Does he know anything of this mortgage?" I said, "I consulted him the morning I left." Well, I had consulted him on a matter of a power of attorney in connection with the mortgage. And that gentleman, who has long since passed to the great unknown, fortunately recommended those bonds, which have long since been paid. I got my money, cabled it to America, and I think that it was probably the only gold that came into Chicago between the delivery of Mr. Bryan's speech and the November election.

So I found myself pretty fully launched into the financial side of the business. We had made some changes in the form of mortgage of the old Chicago Edison Company. Most of the mortgages on public utility properties of that day were so designed that if their provisions were enforced nine public utilities out of ten would have to go into the hands of a receiver. We started to liberalize our mortgage. I had great difficulty with the directors of the Chicago Edison Company as to the amount of the mortgage; two difficulties.

Some of the members of the board objected to the payment of their coupons and principal in gold, and of course it was useless to try to sell a silver bond. The other objection was to the amount of the bond. I think I wanted to make it about $15,000,000. Finally I receded to $10,000,000. And finally the board thought it was doing about all it ought to for its young president, so it fixed the mortgage at $6,000,000. Six million dollars mortgage for an institution that in these days, and for a good many years past, has spent four or five times that amount every year in new construction!

Start of Commonwealth Edison

My next effort at financing was that of the Commonwealth Electric Company. When I came to Chicago there were about 26 or 27 different electric utility undertakings within the city of Chicago. I thought I had come out to run the biggest one. A day or two after my arrival Nolan Fay, who was then running the Chicago Arc Light & Power Company, showed me the figures which indicated that his was the bigger one, so I told him I thought the best thing he could do was to sell his company to mine, because mine was of better credit. He was a little offended by the suggestion, but it ultimately resulted in the purchase being completed by the Edison company, and after getting the largest undertaking in town and combining it with the second largest undertaking in town, I began to cast around and look at these 26 or 27 different undertakings outside of the center of the city.

My board of directors was very conservative. It did not want to deplete the credit of the old Edison company by taking in all these miscellaneous undertakings around town. So I formed the Commonwealth Electric Company, the common stock of which was held for the benefit of the Edison company. At that time I used to see a great deal of the late H. H. Porter, and he talked to me a great deal about the necessity of having mortgages large enough and liberal enough. "Have your trust deeds drawn so that you can get large sums of money if it is ever needed," and I thought I was going to require large sums of money for financing the Commonwealth Electric Company. He suggested that I should have the trust deed drawn for $100,000,000.

Unlimited mortgage originated

Well, that looked like a pretty large figure. No one had suggested any such figure for a mortgage of a local public utility company, and one night at the old Union Club I was discussing the matter with my very dear and late friend William Beal, and I said, "Billy, the board would never stand for a $100,000,000 mortgage." "Well," he said, "what have you got to suggest? You say Mr. Porter advises you to do that. What do you suggest?" I said, "Why can't we have an unlimited mortgage, without any figure being made?" And, gentlemen, that is the origin of the unlimited mortgage in the local public utility business.

Well, after getting out the securities, then came the question of selling them. I tried to get N. W. Harris and Edward L. Brewster to form a syndicate to take, I think it was, the first issue of two millions of bonds under this unlimited mortgage, with conditions in the trust deed that were thought to be absurdly wide open at that time, but which today would be considered very conservative. They told me they could not get a banking group who would take that two millions of bonds, so I finally made an arrangement with the firm of Edward L. Brewster & Company and N. W. Harris & Company to sell the two millions of bonds on commission, without any commitment on their part, and they took some four or five months to make the sale.

Gentlemen, that same mortgage, that same trust deed, is the trust deed of the present Commonwealth Edison Company, and you all know that whenever I have any Commonwealth Edison bonds to sell I make more enemies on account of the firms I leave out than I can cultivate again by the time my next issue comes along.

It simply shows you the difference in point of view of you financial men after you have had a few years of education as to the nature of securities that it is necessary to put out if you expect local public utilities to remain solvent. But it is strange, the prejudice created against that issue was so great that there were very few of our leading banking institutions that would take any of those Commonwealth Electric bonds for a great many years, and I remember one time when I had to go to

London to sell a million and a half of them because I didn't want to go outside of Chicago on this side of the water to sell them. And as I walked into this room this evening I saw some white-haired representatives of some of those same Chicago banks that refused to take those bonds for years, but which are only too anxious to be included in the list when we are placing a few of them now.

I am rambling along with these reminiscences to give you some idea of the difficulties that a public utility man had in the early days. I think probably the next thing of consequence that I had to do with organizing was the North Shore Electric Company, which was organized in 1902, and was originally intended just to do some electric light and power business between Evanston and Waukegan.

My old friend John R. Walsh supplied me with the original money for that enterprise. In proportion to the money we need nowadays it was relatively small.

That company was followed by the Public Service Company, which absorbed the North Shore Electric Company. I mention those two companies because the work in connection with them, together with the development of the steam turbine in the first turbine station built in this country, namely, our present Fifth Street station, those two things have had a great influence on modern electrical development.

The early experiments that we tried in Lake County, the tying up of a number of small communities, concentrating the production of energy in one station, carrying that energy over what we then thought was pretty high tension wires to the locations where the energy was required, that experiment had a very great influence on the development of what we call today super-power.

The building of the Fifth Street station demonstrated that energy could be produced very much cheaper by electro-turbine units than it could be produced by the old form of reciprocating engines. It made the losses of transmission of less consequence because the energy lost cost so much less than under the old scheme, and those two experiments have had what you might call a major influence in the development of the electrical generation and distribution systems of this whole country.

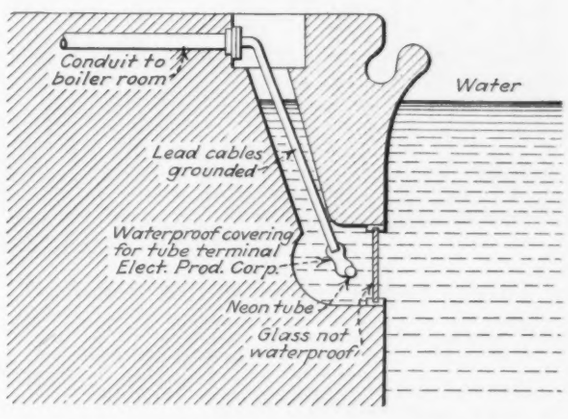
Middle West Utilities launched

Well, with the experience I had around Chicago, and suffering from more or less financial indigestion, because I had about $1,250,000 of my own invested in some plants in southern Indiana where I had started in with partners and ended up by having to carry the load personally, I looked around for some additional properties, small properties to put with my southern Indiana property. We got a few in Illinois, and I think in Wisconsin, and just by accident in getting the Illinois properties we got some business in New England, and we formed the Middle West Utilities Company, formed fundamentally to relieve me of the load I was carrying in southern Indiana, and which I could not continue to carry personally, and I discovered that while people were unwilling to take my southern Indiana prior securities, senior securities, they were perfectly willing to go in with me as partners if I turned in my properties, as I did, for common stock. This I turned in for $1,250,000 and took common stock, and I discovered then for the first time I had a real personal following, and providing I would take people in with me to participate in the profits of the junior securities that I could find lots of men here in Chicago, a few in New York and more in London who were perfectly willing to go along and take the risks of the business. And that is how we came to form the Middle West Utilities Company. My brother had been running the southern Indiana properties and had had lots of grief in doing so, and naturally he came into the larger field of Middle West Utilities Company, and has been having an equal amount of grief ever since.

The secret of success

Your president has been talking of the success that your institution has met with, and rightly talking of that success. I want, for a minute or two, to talk of the success that my institutions have met with. That success has been based upon the treatment that we have accorded to those who have put money in our institutions with us. We do not ask them to go in on any other basis than the basis upon which we go in ourselves. We are not looking, from day to day, merely to fulfill the legal obligations owed to a stockholder. We have in mind all the time the moral obligations that the operator owes to his stockholders. I don't think I need point to any better evidence of the fulfillment of those moral obligations than the course pursued by the Middle West Utilities Company in laying out its refinancing of last year. I think we owe our success very largely to the fact that people believe that we are not looking at things from the point of view of just making money for ourselves. We are looking at things from the point of view of making money for the owners of the property, whether those owners be ourselves or other stockholders who are associated with us. And we think that our success has come from following that policy.

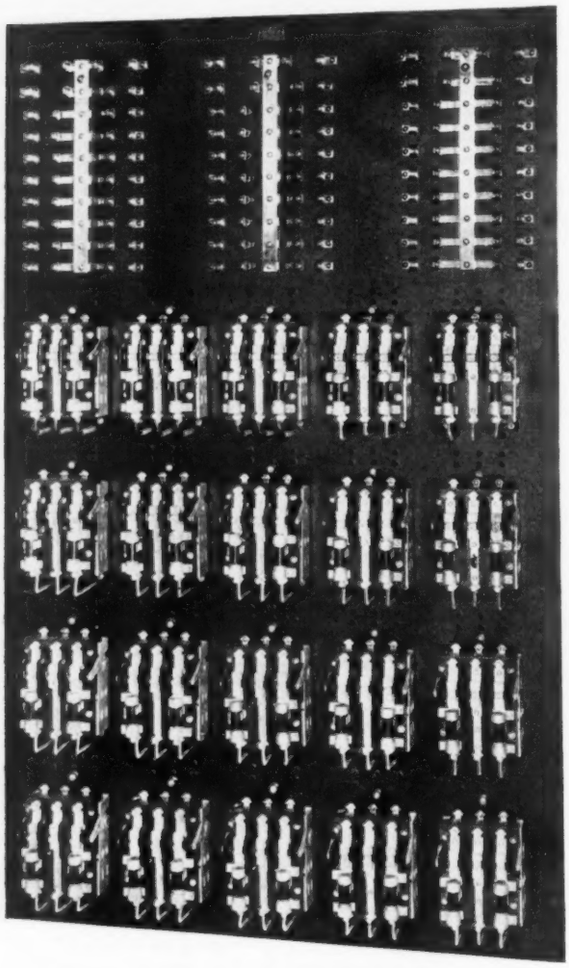
NEON-LIGHTED SWIMMING POOL



In addition to its many others uses, "neon" lighting has now been applied to the lighting of a swimming pool. Using blue light a spectacular and utilitarian job has resulted. Lead cables terminate in a special waterproof fitting where connection to the "neon" tube is made. The tube is supported in a niche which runs around the side walls of the entire tank. In all there are 21 feed points spaced approximately 10 ft. apart.

Concentrated Motor Control

CREAMERIES by nature are difficult to keep dry. Floors, walls and machines are periodically washed down with a hose. This makes for cleanliness, but is not good for electrical equipment. The motors do not suffer so greatly from the moisture as do the control devices and the life of the latter in a creamery is usually short and full of trouble, trouble that is too often an occasion of burns and even fatalities to employees.



Twenty motors controlled from this panel

This board, of ebony asbestos, combines motor protection by the individual fuses at the top with starting by means of magnetic switches. The panel is mounted in a "Duco" coated "Armco" iron box which is rather deep and has long doors on each side, so that the motor circuit wiring is easily done from the back of the panel. Including control and supply circuits 120 conductors are taken off this comparatively small panel.

In order to obviate the elements of electrical hazard and high cost in creamery operation caused by the necessary frequent replacement and assiduous maintenance of control equipment, Swift & Company, with numerous creameries all over the country, tried out the idea of removing the control devices from their customary installations near the motors and concentrating them in locations not subject to excessive moisture conditions. This required a considerably greater investment for wiring, for not only are the motor taps back to the central point longer than when they were hooked directly on a branch of the supply circuit, but also there are the additional push-button control circuits, one for each motor. These increases, however, when balanced against reduced cost of replacement and maintenance of control equipment and greater safety of operation, are relatively unimportant.

Combination control and distribution panels of the type desired were not available when Swift & Company decided to make the change in their creamery wiring practice. It was desired to concentrate the control of as many motors at a single point as was possible, and although simple line start control was used, the motors not running over 7½ hp., the practical doubling of the conductors from the panel due to the added control circuits caused the design of the panel to be rather a special problem. After some experimental layouts had been tried, Swift & Company standardized on the type of board which is illustrated here. This particular panel, which is made by the Trumbull Electric Manufacturing Company, carries controls for twenty motors, sufficient for the average size creamery. If fewer than twenty motors are used the remaining panel positions are available for later installations.

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Revolutions Ratios Facilitate Meter Testing

By MAX A. FAUCETT
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WATT-HOUR meter testing in the usual practice is merely the comparison of the revolutions of a standard with those of the meter under test. Yet this comparison, so simply stated, involves calculation that, when the tester's schedule includes several makes and types of meters, may take up much time, to say the least.

If a table is formed dealing with the disk constants of the 5-amp., 110-volt meters of various makes, all other disk constants and current ratings may be reduced to conform to this table. The problem lies in the tabular solution here reproduced of the formula:

$$N_s = \frac{N_m K_m I_m}{K_s I_s}, \text{ in which}$$

N_s = Revolutions of the standard
N_m = Revolutions of the meter being tested
K_m = Disk constant for 5-amp., 110-volt meter of type being tested
I_m = Current rating of meter being tested
K_s = Disk constant for the standard meter on 5-amp., 110-volt connection
I_s = Current tap on which the standard is being operated for the test

The table gives the solutions for the usual conditions encountered in field testing. Prior to 1915 there were some meters built in which the disk constants were not directly proportional to the ratio of the current rating of the meter to the current rating of the 5-amp. meter of that make and type. This type of meter has been discontinued and is slowly passing out of service.

Recently there have been some types of meters introduced that have new constants, but the table is readily modified to handle these.

The table is very easy to follow. It is based on the constant of the meter and the current rating, and as there are only four constants in general use ($\frac{5}{24}$, $\frac{1}{4}$, $\frac{3}{10}$, $\frac{1}{3}$) for both standard and consumers' meters, they are known to every meter tester, while the current rating may be read from the nameplate and the tester himself must set the tap on the standard. Several examples show the method of using the table in conditions to be encountered in usual practice.

TABLE THAT HELPS THE METER TESTER

General Formula: $N_s = \frac{N_m K_m I_m}{K_s I_s}$

Row	Column				1	2	3	4	5	6	7	8	9	10	11	Row
					(I_m) Current Capacity of Meter											
1				1	.....	.....	.....	.....	.....	.....	.....	.....	3	5	10	1
2				5	3	.....	.....	.....	5	.....	.....	.....	.....	.....	.....	2
3				10	.....	.....	.....	.....	10	.....	.....	15	.....	.....	.....	3
4	(I_s) Current Capacity of Standard			20	.....	.....	15	.....	20	.....	25	.....	.....	.....	.....	4
5				25	15	.....	.....	20	25	30	.....	.....	.....	.....	.....	5
6				40	.....	25	30	.....	40	.....	50	.....	.....	.....	.....	6
7				50	30	.....	.....	40	50	60	.....	.....	.....	.....	.....	7
8	(K_s) Standard Constant			100	60	.....	75	80	100	.....	.....	.....	.....	.....	.....	8
					Revolutions of Standard Per Revolution of Meter 5 amp., 110 volt—Meter and Standard											
	5 24	1 4	3 10	1 3												
1	....	....	....	5 24	0.3750	0.3906	0.4688	0.5000	0.6250	0.7500	0.7813	0.9375	1.8750	3.1250	6.2500	1
2	....	....	5 24	....	0.4167	0.4340	0.5208	0.5556	0.6944	0.8333	0.8681	1.0417	2.0833	3.4722	6.9444	2
3	....	....	....	1 4	0.4500	0.4688	0.5625	0.6000	0.7500	0.9000	0.9375	1.1250	2.2500	3.7500	7.5000	3
4	....	5 24	1 4	....	0.5000	0.5208	0.6250	0.6667	0.8333	1.0000	1.0417	1.2500	2.5000	4.1667	8.3333	4
5	....	....	....	3 10	0.5400	0.5625	0.6750	0.7200	0.9000	1.0800	1.1250	1.3500	2.7000	4.5000	9.0000	5
6	5 24	1 4	3 10	1 3	0.6000	0.6250	0.7500	0.8000	1.0000	1.2000	1.2500	1.5000	3.0000	5.0000	10.0000	6
7	....	....	1 3	....	0.6667	0.6944	0.8333	0.8889	1.1111	1.3333	1.3889	1.6667	3.3333	5.5555	11.1110	7
8	1 4	3 10	....	....	0.7200	0.7500	0.9000	0.9600	1.2000	1.4400	1.5000	1.8000	3.6000	6.0000	12.0000	8
9	....	1 3	....	....	0.8000	0.8333	1.0000	1.0667	1.3333	1.6000	1.6667	2.0000	4.0000	6.6667	13.3330	9
10	3 10	....	....	....	0.8640	0.9000	1.0800	1.1520	1.4400	1.7280	1.8000	2.1600	4.3200	7.2000	14.4400	10
10	1 3	....	....	....	0.9600	1.0000	1.2000	1.2800	1.6000	1.9200	2.0000	2.4000	4.8000	8.0000	16.0000	11
11	Column.....			.....	1	2	3	4	5	6	7	8	9	10	11	

(K_m Meter Constant)

Example No. 1.—Meter, Duncan, single-phase, two-wire, 110-volt and 50-amp. Standard, Westinghouse (testing with 40-amp. tap).

Under K_s find 1/3 for the Westinghouse standard, follow this column until the constant 1/4 is intercepted, which is the Duncan constant K_m (this interception takes place on the third row). Starting at the standard meter tap current, which is 40 amp., read across until the current I_m, which is 50 amp., is intercepted; this determines the proper column. Follow this column (7) until the row previously determined is intercepted. At the point of intersection of column (7) and row (3) is read the constant 0.9375, which indicates the number of revolutions the disk of the standard should make for one revolution of the meter disk. For light loads, where it is desirable to take two revolutions of the meter disk, the standard will make 0.9375 x 2 revolutions, or 1.87 revolutions, and where a normal load is being tested the meter disk will be calibrated for ten revolutions and the standard should make 0.9375 x 10, or 9.37 revolutions. This example should clearly indicate the general process of applying the table.

Example No. 2.— Meter, G.E., single-phase, three-wire, 110-220-volt and 25-amp. Standard, Sangamo (testing with 25-amp. tap and 220-volt potential tap).

The two current coils in this case are connected in series for testing. Read K_s 5/24 to K_m 3/10, which leads to row ten, read I_s 25 to I_m 25, which leads to column five. The intersection of this row and column falls on 1.44, which is the number of revolutions made by the standard disk to every revolution of the meter disk. When this is multiplied by the number of revolutions taken on the meter during the test it will give the number of revolutions that should be made by the standard at the same time.

Example No. 3.—Meter, Duncan, three-phase, two-element, three-wire, 110-volt and 5-amp. Standard, G.E. (testing with 5-amp. tap).

The test is made with the current elements in series. Read K_s 3/10 to K_m 1/4, which leads to row four, then read I_s 5 to I_m 5, which leads to column five. This gives the ratio of revolutions as 0.833. Multiply this factor by the number of revolutions of the meter tested to obtain the number of revolutions the standard should make. This factor can be used in this manner without any multiplier, since the disk constant of the meter is reduced one-half when the elements are connected in series. If each element is to be tested it would be necessary to multiply the factor by two, for there would be no change in the disk constant.

Example No. 4.— Meter, Westinghouse, three-phase, two-element, three-wire, 220-volt and 15-amp. Standard, Duncan (testing with 10-amp. tap and 220-volt potential coil).

The test is made with the current coils in series. Read K_s 1/4 to K_m 1/3, which leads to row nine, then read I_s 10 to I_m 15, which leads to column eight. This gives the ratio of revolutions as two. Now if instead of the 10 amp. coil the tap is placed at 25 amp. the following combination will result: Read K_s 1/4 to K_s 1/3, which leads to row nine, then read I_s 25 to I_m 15, which leads to column one; this gives the ratio as 0.800. As in example No. 3, the disk constant of the meter has been halved by the connecting of the elements in series. If one element is to be tested the factor must be multiplied by two.

Example No. 5.—Meter, Westinghouse, three-phase, two-disk, four-wire, 110-volt and 40-amp. Standard, Sangamo (test with 50-amp. tap).

The current elements of the meter being tested are connected in series. Read K_s 5/24 to K_m 1/3, which leads to row twelve, then read I_s 50 to I_m 40, which leads to column four. At the intersection of row twelve and column four the ratio 1.28 may be read. This factor may be used directly, since the three current elements have been connected in series and therefore the disk constant has been divided by four.

Example No. 6—Meter, Sangamo, three-phase, three-element, three-disk, 110-volt and 5-amp. Standard, G.E. (testing with 5-amp. tap).

The test is to be made with the three elements in series. Read K_s 3/10 to K_m 5/24, which leads to row two,, then read I_s 5 to I_m 5, which leads to column five. At the intersection of this row and column the factor is 0.6994. With the current elements in series the meter is the same as a single-phase meter and the factor determined is directly applicable.

In the case of testing the new I-16, G.E. meter, which has a disk constant (for the 110-volt, 5-amp. meter) of 6/10, it is only necessary to use K_m as 3/10 and multiply the factor by two. In the case of the Sub-E Westinghouse meters, with a disk constant of 1/6, it is only necessary to use the K_m as 1/3 and multiply the factor by 0.5. By the use of this type of conversion on the table it is possible to take care of all the odd types of disk constants. In the case where there is a meter current that does not appear, such as the 150-amp., self-contained type, the right constant may be easily derived by making use of the general formula shown in the table.

When using current or potential transformers there is no change in the ratio, for the transformer automatically reduces the disk constant of the meter being tested to that of a 110-volt, 5-amp. meter.

Measuring Values in Substation Design

By L. C. PETERMAN and W. A. WHITE

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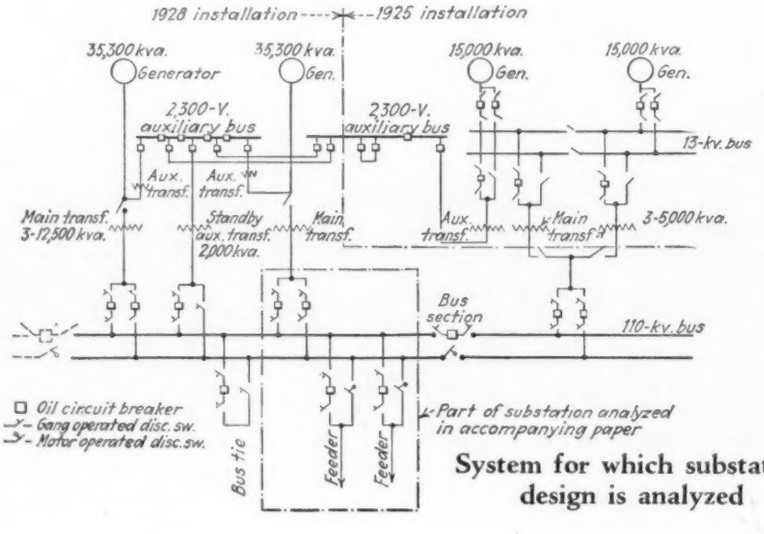
ECONOMIC comparisons of high-tension substations show that little difference can be had in costs from the design point of view. The chief inducement to design study is the possibility of cost reductions through the elimination of equipment and the development of a layout with greatest operating simplicity and reliability.

THE popularity and rather wide use of the so-called "ground bus," originally developed on the Pacific Coast, which utilizes rigid tubing on low insulator supports, makes it worthy of analysis to determine its economic status compared to other designs. The principal appeal of this type of station is the absence of elaborate steel structures, the minimizing of wire crossings over buses and the rigidity and high mechanical strength of the bus-supporting structures.*

This type of station is here compared with various other designs which might be used. For simplicity, three bays only are shown and estimated, these consisting of a generator (or transformer) bay and two feeder bays, the generator bay having two oil circuit breakers and the feeder bays having one oil circuit breaker each. It is assumed that the substation is located adjacent to a generating station, that the generator voltage is stepped up to 110 kv. through transformers (not shown or estimated) and that all main switching is done on the high-tension side of the transformers, which connect to the switching structure in the same way that outgoing feeders are connected. The general scheme of electrical connections and switching—that is, the "one-line diagram"—is the same for all designs compared.

Plan A shows details of the "ground bus" design such as was used at Sterlington. Plan B is substantially the same design except that a strain bus has been substituted for the rigid tube bus. Comparison 1 indicates that the strain bus is cheaper by about $5,000. Plan B has one advantage over plan A in that the bus taps pass under the bus. Mechanical failure of one tap probably would not involve the entire bus, as would be the case with plan A.

Comparison 2 treats with a design which moves the two buses to the center of the structure, with feeder pull-offs taken from the outside of the structure. Although there are twice as many wire crossings over buses as in plans A and B, plans C to G inclusive have the advantage that a feeder can be connected to or disconnected from the structure without shutting down either bus. This would be an advantage on a growing system where such changes are sometimes necessary.



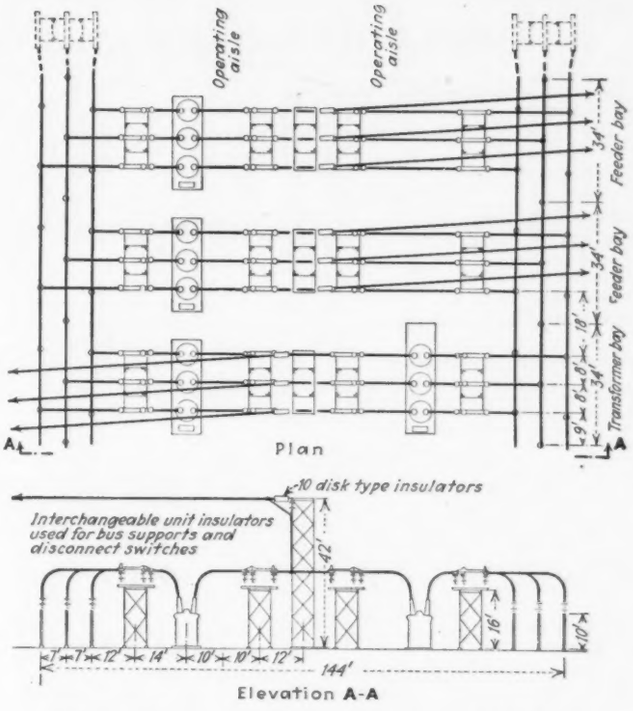
System for which substation design is analyzed

**Companies using this type of station are: Public Service Electric & Gas Company, New Jersey,* ELECTRICAL WORLD, *September 25, 1926; Southern Calif. Edison Company, Los Angeles,* ELECTRICAL WORLD, *September 22, 1928, and March 9, 1929; Mississippi Power & Light Company, Jackson, Miss.,* ELECTRICAL WORLD, *January 7, 1928; Philadelphia Electric Company, N.E.L.A. publication, 278-39; Louisiana Power & Light Company, Sterlington, La.*

Plans C to F are the same electrically, the difference between them being limited to changes in design of the steel structure. Some engineers prefer very light latticed structures, which, though adequate for the wire tension used, sometimes have such small sections that a workman cannot climb over them without causing serious deflection. Other engineers insist that solid rolled sections, riveted and painted, are preferable to light galvanized latticed structures because it is claimed appearance is improved and lower maintenance cost effected. Others desire to eliminate trusses altogether on the basis that the least possible steel is desirable for appearance sake and also to make possible, at very low cost, extremely wide separation between oil circuit breakers, transformers, etc.

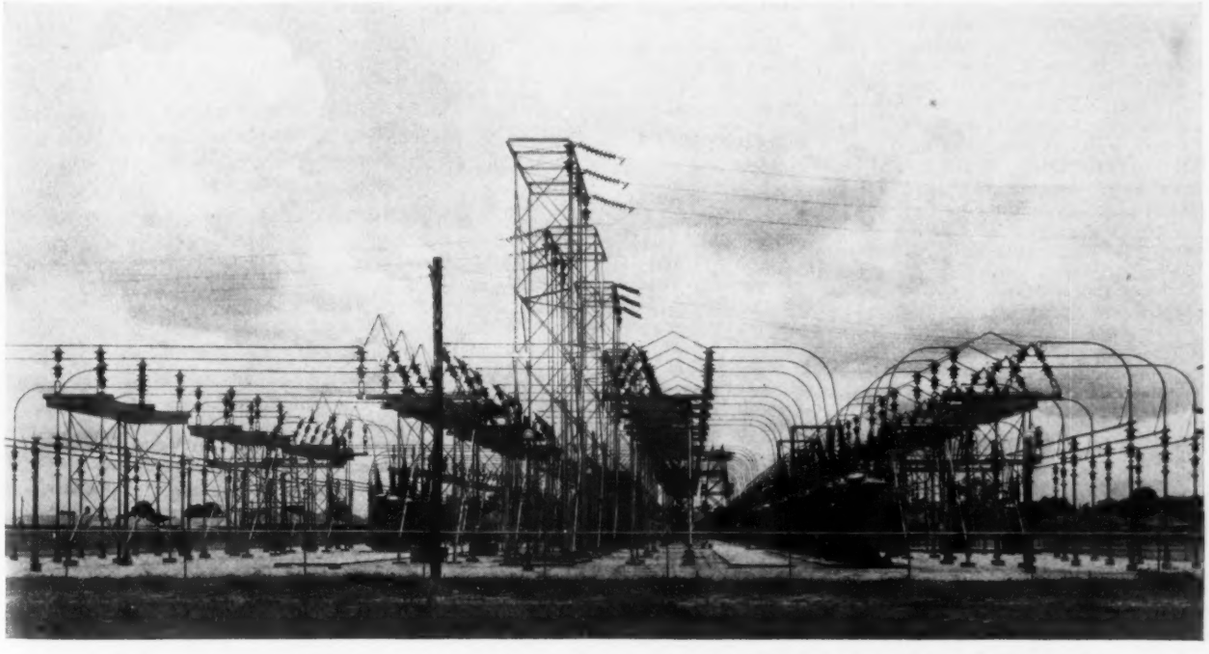
Comparison 2 shows that there is only a very small saving in eliminating trusses altogether in favor of wide-base, dead-end towers (plan F) and no saving at all in using solid rolled sections, in spite of a liberal allowance being made for a lower cost per pound in fabricating and erecting the heavy rolled sections (plan E). Likewise, the idea that large savings are to be made by using the lightest possible steel sections is disproved by comparison 3. An increase in the tension in the wires from 1,000 lb. to 2,500 lb. increases the cost of the steel structure less than $500 per bay. In some designs increased sags, increased numbers of insulators or increased difficulties with the electrical design occasioned by the use of the light steel might easily cost several times this saving.

Comparison 4 arrives at the same result for wide-base, dead-end towers as was noted for latticed trusses and towers in comparison 3. Even in the case of an extremely heavy tower, designed for a special job where it was desired to develop the breaking strength of three 336,000-circ.mil. A.C.S.R. conductors, the increase in cost using this tower (plan FFF) was less than $6,000 for the three bays over the cost of towers for 1,000 lb. conductor tension.



Plan A for 110-kv. substation—rigid bus

The design of minimum cost is shown to be plan G, which utilizes vertically mounted disconnect switches. Many engineers dislike this type of construction because of the cantilever stresses in the long, heavy insulator stacks and also because the cement between insulator sections is exposed to action of the weather. However, responsible manufacturers of this equipment assert that their designs are ample and adequate for such mounting



High-tension substation of Louisiana Power & Light Company at Sterlington, La.

TABLES I TO IV—COMPARATIVE COSTS OF DIFFERENT CONSTRUCTION

All estimates are net, without allowance for engineering, general overhead charges or contingencies.

Comparison No. 1

1,000-Lb. Pulloffs Plan	Outside Rigid Bus A	Outside Strain Bus B
Insulators	$3,115	$2,252
Bus wire and tubing	6,390	1,829
Copper connectors	2,250	1,113
Steel structures	3,686	3,904
Foundations	1,136	2,417
Disconnect switches three-phase, 132 kv	10,000	10,000
Oil circuit breakers and foundations, 132 kv	74,400	74,400
	$100,977	$95,915

Comparison No. 2

1,000-Lb. Pulloffs Plan	Horizontal Disconnect Switches: Trussed Latticed Structure C	Isolated Dead-End Trusses D	Trussed Solid Rolled Sections E	Isolated Dead-End Towers F	Vertical Disconnect Switch, Trussed Latticed Structure G
Insulators	$3,124	$3,124	$3,124	$3,124	$3,057
Bus wire and tubing	1,958	1,958	1,958	1,958	1,061
Connectors	829	829	829	829	862
Steel structures	5,142	4,465	6,383	3,422	2,480
Foundations	1,592	2,930	1,592	1,995	686
Disconnect switches three-phase, 132 kv	10,000	10,000	10,000	10,000	10,000
Oil circuit breakers and foundations, 132 kv	74,400	74,400	74,400	74,400	74,400
	$97,045	$97,706	$98,286	$95,728	$92,546

Comparison No. 3

Plan	Trussed Latticed Structure 1,000-Lb. Pulloffs C	2,500-Lb. Pulloffs CC
Insulators	$3,124	$3,124
Bus wire and tubing	1,958	1,958
Connectors	829	829
Steel structures	5,142	6,182
Foundations	1,592	1,950
Disconnect switches three-phase, 132 kv	10,000	10,000
Oil circuit breakers and foundations, 132 kv	74,400	74,400
	$97,045	$98,443

Comparison No. 4

Plan	Isolated Dead-End Towers Horizontal Mtd. Switches 1,000-Lb. F	2,500-Lb. FF	16,900-Lb. FFF
Insulators	$3,124	$3,124	$3,304
Bus wire and tubing	1,958	1,958	1,958
Copper connectors	829	829	829
Steel structures	3,422	3,757	7,230
Foundations	1,995	3,412	3,849
Disconnect switches three-phase, 132 kv	10,000	10,000	10,000
Oil circuit breakers and foundations, 132 kv	74,400	74,400	74,400
	$95,728	$97,480	$101,570

Basis of Steel Design

1,000-lb. Pulloffs: Wire dead load plus ½-in. ice, plus 8 lb. wind at 0 deg. F. Maximum tension in steel 24,000 lb. per square inch.

2,500-lb. Pulloffs: Wire dead load plus ¾-in. ice, plus 11 lb., wind at 0 deg. F. Maximum tension in steel 30,000 lb. per square inch.

Substation Plan A

Steel structure: Individual latticed towers for line pulloffs and disconnect switch supports. Bus insulators mounted on short steel pipes anchored in concrete. Pulloffs: From center structure 1,000 lb. per wire.

Bus: Rigid copper tube bus, supported on insulators at 17-ft. intervals. All connections to bus of copper tubing.

Connectors: Clamp type with non-rusting bolts.

Insulators: Switch and bus support insulators pedestal type, each unit consisting of two Locke 9944, 73,000-volt or similar. Strain insulators Ohio Brass No. 2562O or similar.

Disconnecting Switches: Three-pole, gang-operated, rotating insulator knuckle-joint type, Delta Star, General Electric or similar.

Oil Circuit Breakers: 1,500,000-kva. rupturing capacity.

Above description of connectors, insulators, disconnect switches and oil circuit breakers common to all plans below.

Substation Plan B

Steel structure: Individual latticed towers for line pulloffs and disconnect switch supports. Latticed narrow base towers with latticed connecting trusses for supporting bus.

Bus: Stranded hard-drawn No. 4/0 copper bus in strain position between dead-end trusses, with intermediate pedestal insulator supports.

Pulloffs: From center structure, 1,000 lb. each.

Substation Plan C

Steel structure: Narrow base latticed towers with latticed trusses interconnecting all towers for supporting buses. Rigid connections assumed between towers and trusses. Separate low towers for horizontal mounted disconnect switches.

Bus: Strain bus of No. 4/0 hard-drawn copper wire.

Pulloffs: From outside of structure, 1,000 lb. each.

Substation Plan CC

Same as C except 2,500-lb. pulloffs.

Substation Plan D

Steel structure: Narrow base latticed towers with latticed isolated dead-end trusses. Heavier trusses, but smaller number than required for plan C. Also heavier foundations. Separate low towers for horizontal mounted disconnect switches.

Bus: Strain bus of No. 4/0 hard-drawn copper wire.

Pulloffs: From outside of structure, 1,000 lb. each.

Substation Plan E

Steel structure: Towers and trusses of solid rolled sections. All towers (columns) interconnected with trusses. Rigid connections assumed between towers and trusses. Separate low towers for horizontally mounted disconnect switches.

Bus: Strain bus of No. 4/0 hard-drawn copper wire.

Pulloffs: From outside of structure, 1,000 lb. each.

Substation Plan F

Steel structure: Isolated wide-base dead-end towers without interconnecting trusses. Disconnect switches mounted horizontally on separate low towers. Intermediate bus supports between dead-end towers of light latticed towers and trusses.

Bus: Strain bus of No. 4/0 hard-drawn copper wire.

Pulloffs: 1,000 lb. each.

Substation Plan FF

Same as plan F except 2,500-lb. pulloffs.

Substation Plan FFF

Same as plan F except 16,900-lb. pulloffs.

Substation Plan G

Steel structure: Narrow base latticed towers with latticed trusses interconnecting all towers. Rigid connections assumed between towers and trusses. Disconnect switches mounted vertically on trusses which are an integral part of the main structure. This mounting of disconnect switches reduces steel and ground area required over all preceding designs.

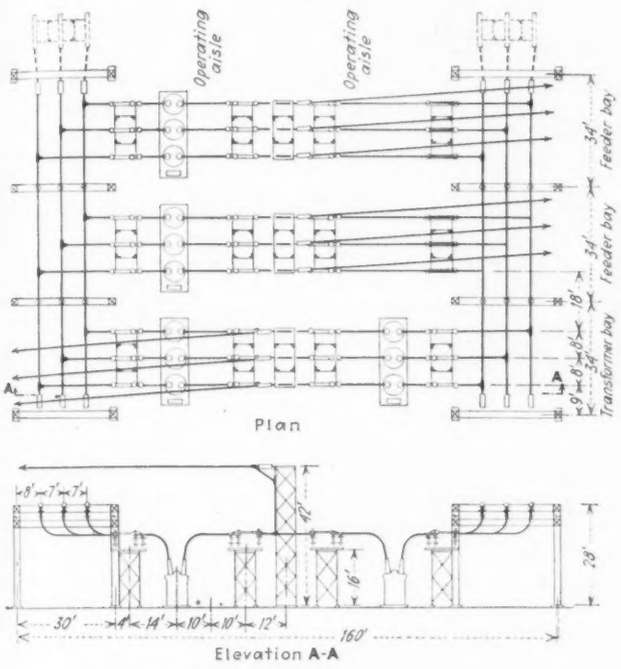
Bus: Strain bus of hard-drawn copper wire.

Pulloffs: From outside of structure, 1,000 lb. each.

and have less hesitancy in recommending their switches for such installation than some engineers have in installing them. Moreover, the vertical mounting has been used in various installations with apparent success and there seems to be no good reason why this design should not be used if it actually shows a lower cost for a particular substation, as it does in this case.

Based on the particular design and construction methods in this comparison, the following conclusions can be drawn:

1. For most of the substation types, the difference in cost is so slight that the decision to use one particular de-



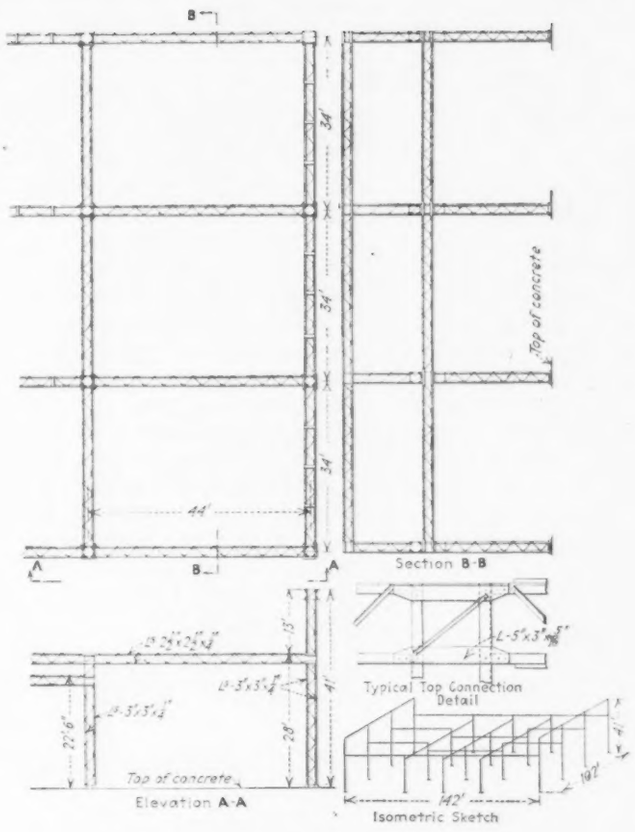
Plan B for 110-kv. substation—outside strain bus

sign can be based upon operating or other advantages and cost is not an important factor. Decision to use the cheapest design must be based on an evaluation of possible operating hazards (if any) introduced by the cheapened construction.

2. Steel structures consisting of solid rolled sections are more expensive than latticed structures and are not generally desirable for high-voltage substations on account of the long spans involved. The long spans require excessive weights of steel unless bracing is used which may cut down electrical clearances. This, in turn, requires increased spans, which partially defeats the advantage of the bracing.

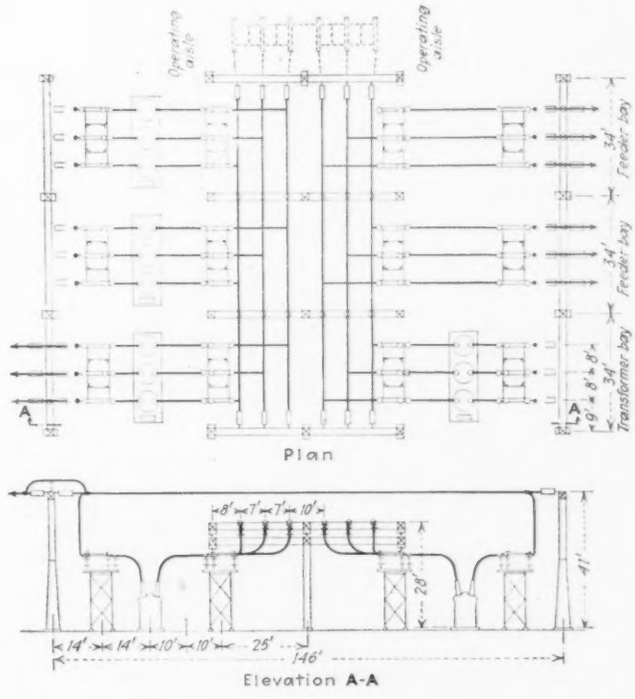
3. A high-tension substation using a heavy copper tube bus has generally been recognized by engineers in the past as being more expensive than a cable strain bus.* The "ground bus" arrangement, which takes the bus off high structures and places it on low insulator supports, does

*"*Copper tube is most economical for compact substations. . . . For voltages of 66,000 and under, the smaller ground area required and the lighter sections that can be used show definite savings in favor of the copper tube bus compared with the cable strain type. For voltages higher than 66,000 the cable strain bus will usually be found more economical than the rigid bus."—Publications of Burndy Engineering Company.*

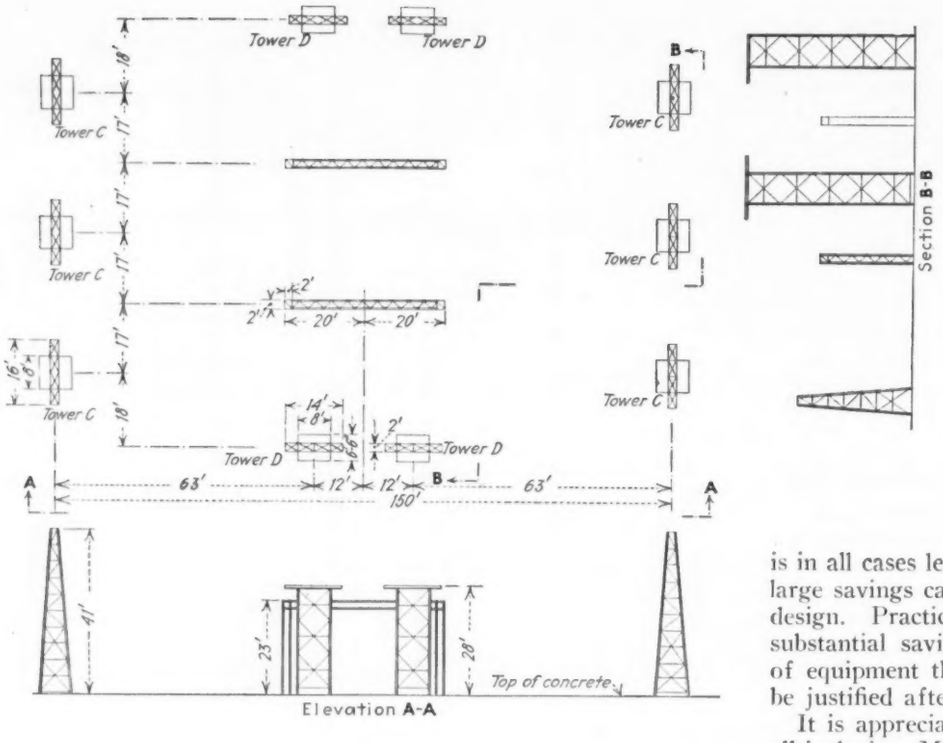


Typical latticed substation sections

Plan C—1,000-lb. pulloffs. Weight of steel, 19.5 tons, design similar.
Plan CC—2,500-lb. pulloffs. Weight of steel, 25.9 tons—design as shown.



Plan D for 110-kv. substation, inside strain bus



Substation structure—A towers

Plan F—1,000-lb. pulloffs, similar design. Weight of steel, 7.2 tons.

Plan FF—2,500-lb. pulloffs, design as shown. Weight of steel, 10.8 tons.

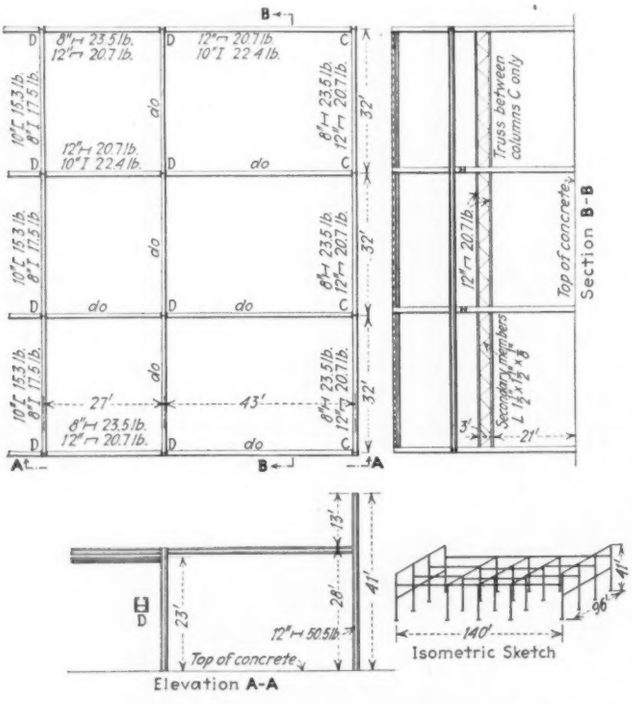
Plan FFF—16,900-lb. pulloffs, design similar. Weight of steel, 40 tons.

not alter the fact that tubing is more expensive than cable where wide spacing is involved.

4. Neglecting plan FFF, which would probably never be used, the variation between the most expensive plan and the least expensive is $8,431. The average cost is $96,991. Of the plans intermediate between the maximum and the minimum, the variation from the average is in all cases less than $1,500, showing that no large savings can be effected by refinements in design. Practically the only means of making substantial savings is to eliminate every item of equipment the installation of which cannot be justified after the most searching analysis.

It is appreciated that this comparison is not all-inclusive. Many additional variations might have been considered, and it is also possible that an entirely different result might have been secured if the basic one-line diagram were made more elaborate. However, we heartily agree with M. M. Samuels† that many designs are unnecessarily elaborate and that simplicity in any design is a virtue of the first order. The comparatively simple one-line diagram used will be adequate for the majority of systems.

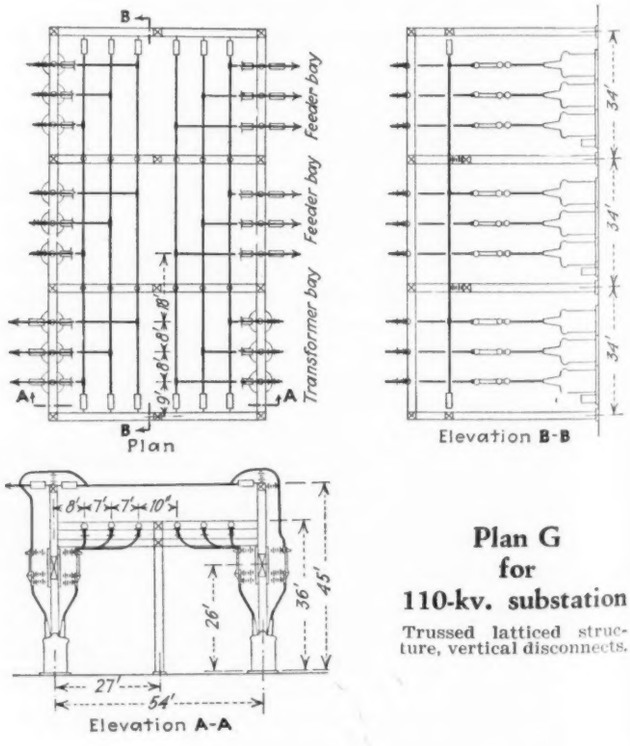
†ELECTRICAL WORLD, *June 4, 1927, page 1197, et seq.*



Substation structure, rolled sections

Plan E—1,000-lb. pulloffs, similar design with lighter steel. Weight of steel, 33.5 tons.

Plan EE—2,500-lb. pulloffs, design as shown. Weight of steel, 43.5 tons.



Plan G for 110-kv. substation

Trussed latticed structure, vertical disconnects.

Flexible Lighting for Stores and Offices

BUILDING owners often have in mind future uses of portions of the floor space for different purposes than originally planned. The architect, electrical consultant and electrical contractor are under obligations to provide light and power facilities that will make such conversion possible with a minimum of revamping and expense. This is especially true of new structures with buried conduit because the cost of subsequent changes is usually prohibitive if not impossible of attainment.

Westcott & Mapes, Inc., New Haven and New York City, cite a specific instance of a 5- and 10-cent store facing on two streets which serves to emphasize points where the building owner was materially aided in getting maximum present and future realization of his rental possibilities. At the same time a considerable degree of concentration in control and flexibility for submetering for any likely subdivisioning are desirable things to provide for the benefit of the owner.

In this case an L-shaped space on the first floor was partitioned off and rented. The most advantageous layout of ceiling outlets for this space did not correspond with the best layout for the owner's store area. In the event of the removal of the partitions and occupancy of the enlarged area by the owner, it was found desirable to provide an idle conduit run which would fit the pattern adopted for the balance of the first floor area. The owner required the location of all control of lights for the first floor and basement at one concentrated point adjacent to the stairway to the basement. This of course increased the length and size of feeder copper, but the advantages offset the added cost to the owner. A lunch counter along one of the walls on the outside of the L might also later be duplicated by one along an opposite wall; an idle conduit run was therefore provided on

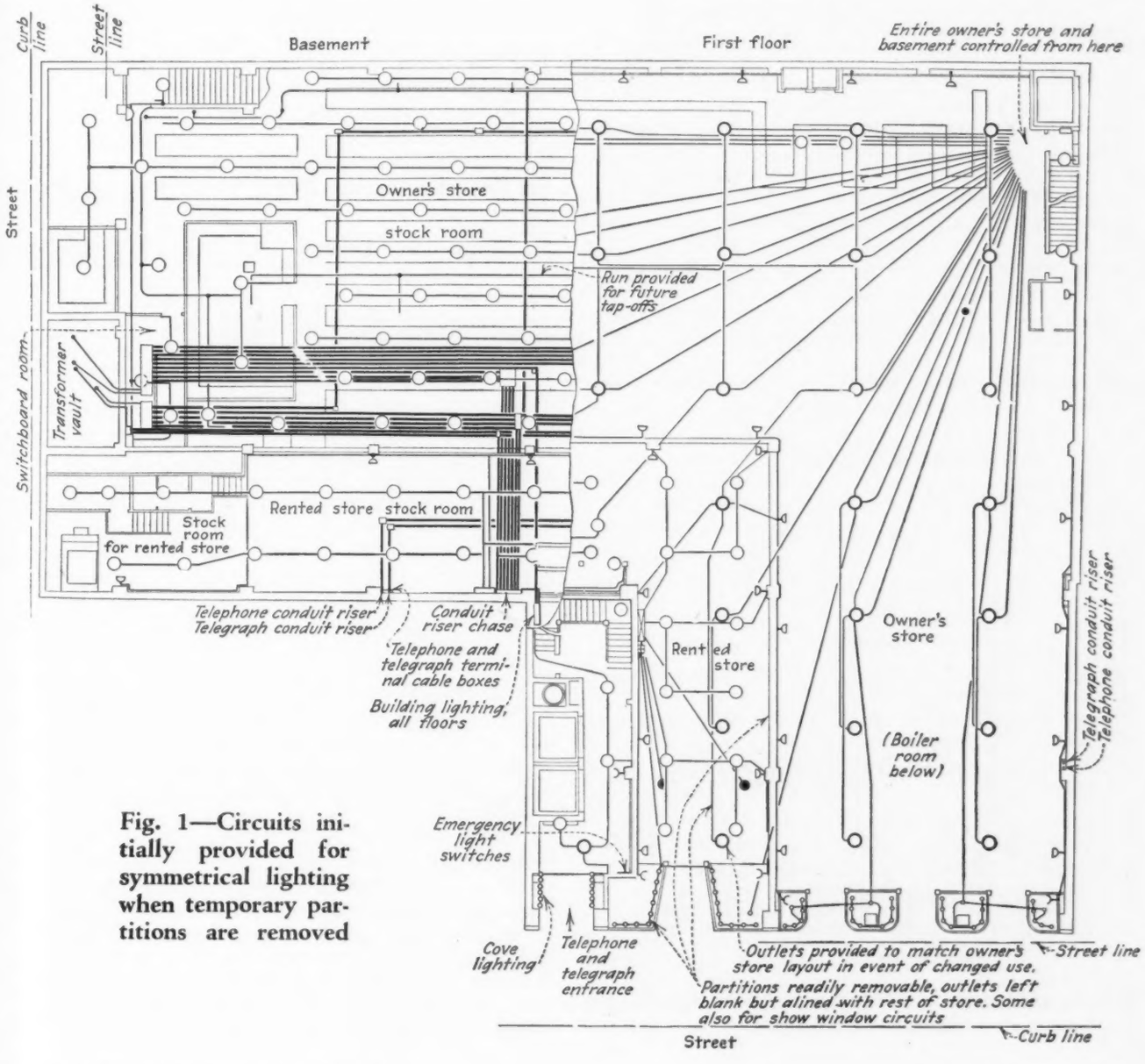


Fig. 1—Circuits initially provided for symmetrical lighting when temporary partitions are removed

the basement ceiling with outlets available for drink mixer motors, etc., as desired.

At present each second floor wing of the L is rented as a single room. Future considerations dictated the likelihood of partitioning these areas into small offices. The circuits were so arranged (Fig. 2) as to facilitate this subdivisioning. The submetering panel adjacent to the conduit riser chase was provided with jumper terminals so arranged that any probable combination of partitioned rooms taken by each tenant could be metered by a single meter. Similar provision was made for further subdividing the small offices into which the upper floors are now divided.

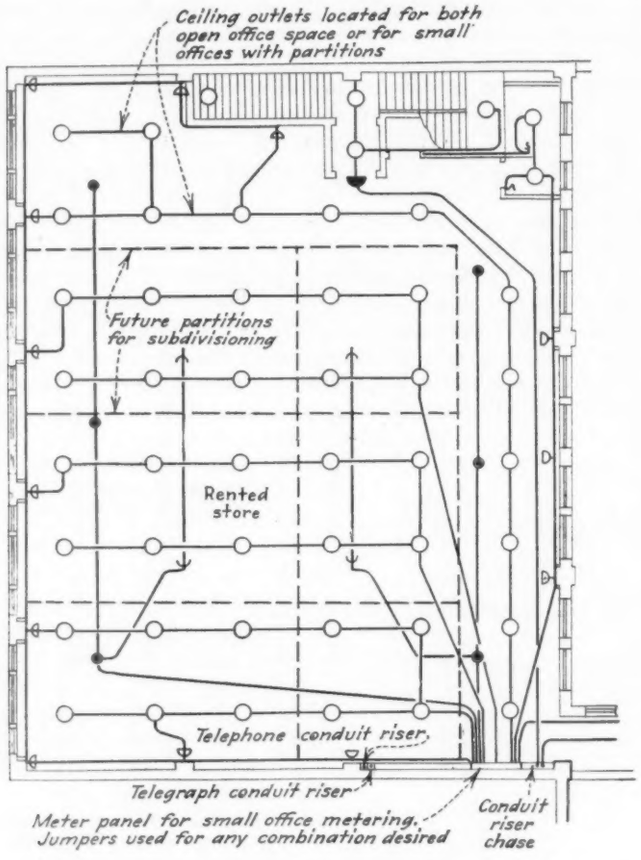

Ceiling outlets located for both open office space or for small offices with partitions
Future partitions for subdivisioning
Rented store
Telephone conduit riser
Telegraph conduit riser
Meter panel for small office metering. Jumpers used for any combination desired
Conduit riser chase

Fig. 2—Circuits arranged for future subdivision of present large offices

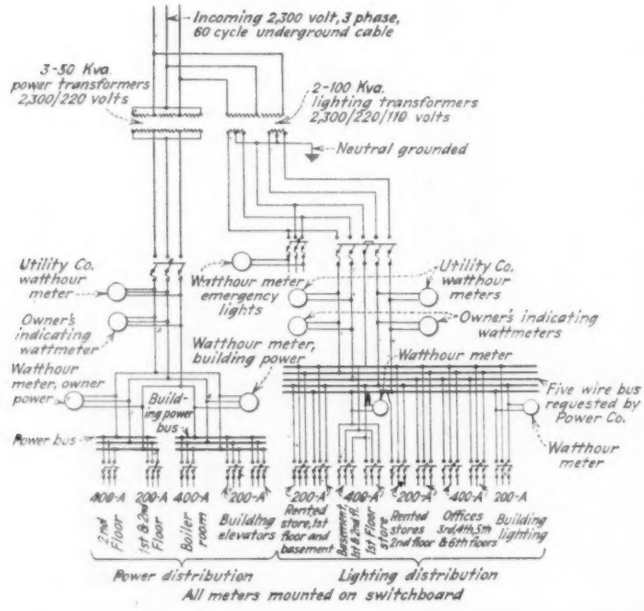


Fig. 3—Adequate metering segregates owner's cost of power and light

Other points of interest are the necessity of locating the transformer vault along the street wall, preferably under the sidewalk, and placing the switchboard room immediately adjacent to the transformer vault. Building owners are prone to force the architect and electrical consultant to resort to persuasion in this matter. Coal pockets, delivery elevators and ventilators usually command location along the street front, but the entrance for electric service should be given adequate recognition for claim to similar location. Metering for tenant billing and for record of operating costs are not always given the consideration to which it is entitled; it was, however, in this instance. Complete provision (Fig. 3) was made for individual metering of rented stores, rented offices, owner's store and building service. It was also possible in this case to secure straight vertical runs for all risers, including those for telephone and telegraph, watchman's clock service, etc.

▼ ▼ ▼

Broken and High-Resistance Grounds Often Overlooked

By M. M. SAMUELS
J. G. White Engineering Corporation

ACCIDENTAL grounds, breaks in purposely established ground connections and high-resistance grounds are probably the most frequent causes of ground trouble in industrial systems. Ground-detecting lamps or other devices are extensively used to determine that a ground exists, find its location and clear it. But the other causes of trouble are frequently forgotten after the inspector approves the ground connections. Still, inspections of factory installations, a year or two after they are completed, will often reveal broken-ground connections. Sometimes the soil conditions change and what was once a low-resistance ground becomes a high-resistance ground.

The causes for this neglect are twofold. Until recent years there were not any very rugged and reliable standard connectors for making ground connections. This situation has been remedied and now a great variety of very reliable connectors are available. Factory engineers should see that nothing but reliable connectors are used on their system, the added cost over the old makeshifts being merely a matter of cents. Formerly to locate ground faults a very complicated procedure had to be followed requiring the use of bridges, laboratory instruments and the services of a man skilled in handling such equipment and interpreting the results. But now instruments are available which make it possible to test ground resistance in a few seconds. They can be handled by any electrician or radio bug.

Law and the Engineer

Public utility operations touched by law in many places. Need for engineers to understand legal principles and for lawyers to understand the utility business

By DAVID E. LILIENTHAL

Attorney-at-Law, Chicago, Ill.

WHERE the ordinary business has one contact with the law the public utility business has a hundred. The public utility operator not only must conform to most of the laws which affect those engaged in the ordinary business pursuits but, in addition, because his business is a "public service," he is subject to the most intricate and comprehensive regulation by law ever attempted in all the history of government. Acts which in the ordinary business may be done without let or hindrance can be done in the public utility business, for the most part, only after complying with legal conditions or only with the consent of some legal tribunal, such as a state commission, a county board, or a city council. Not only the major acts of management, relating to rates, extensions, financing and abandonment, but even such details as the proper type of equipment, construction methods or consumer credit rules are the subjects of this all-enveloping legal control.

It would be surprising if this constant necessity for the sanction of the law did not have a direct effect on the qualifications of the engineers, the business men and the economists who are responsible for the operation of the light and power industry.

And it was equally inevitable that because of the legal labyrinth which has grown up about the public utility business the importance of the lawyer should increase. And as a corollary, it has come about that the powers of deductive reasoning which characterize the successful business lawyer generally are not sufficient qualifications for the effective public utility legal counselor.

The public utility managerial officer—whether administrator, engineer, economist or accountant, in daily, almost hourly contact with the law of public utilities—must have a genuine comprehension of the principles which are fundamental in that field of law. It has been my observation that productive managerial and technical ability and an understanding of the legal foundations of the industry usually appear in the same individual. And while this would be pure coincidence in, say, the steel industry or the paper industry, a consideration of some illustrative instances show that in the public utility business it is inevitable, as a direct result of the unique inter-relation between sound public utility law and sound public utility economics and engineering.

Take, by way of illustration, a situation upon which the writer was recently consulted. An electric company sought to increase its rural business. The rate engineer in charge considered the matter first of all as a business and engineering problem. How can an extension be constructed to the farmer's property with the minimum of capital outlay by the company; what kind of extension policy and rate form will encourage the farmer to become a substantial user of electric service? The engineer worked out an extension and rate policy providing for construction of the line at the company's expense, for a consumer deposit against the cost of the extension, a service charge varying with the length of the particular extension, and a commodity charge. It was our engineer associate's conclusion that, as a business and technical proposition, this plan was sound. Immediately this first question was settled a second arose: Is the plan *legally* sound? Does it violate any specific statutory provision forbidding a service charge? Does it violate a commission general order regulating consumers' deposits? Does it run counter to a well-established commission practice as to contributions to the cost of rural extensions? Does it involve an unreasonable discrimination against one class of consumers as compared with another, or between members of the same class? What are the economic and technological *facts* which will demonstrate the reasonableness of the plans as a matter of *law?* The questions could be enumerated at even greater length.

Law involved in much engineering

Lest we be misunderstood, let us say at once that we do not mean to intimate that an engineer, or any managing officer, is, or should be, qualified to answer finally all the legal problems raised by even so simple an act of management as the above instance. What we do mean is that he must recognize a legal problem when he sees one—no mean task, as many laymen and not a few lawyers can testify, to their sorrow! He must be able to translate the legal opinions furnished him by his lawyer into terms of business policy or engineering practice. And where, as so frequently happens in the law of public utilities, the legal answer depends upon economic or engineering facts and principles, he should be qualified to recognize which of those facts have legal relevance. Some lawyers would go even further and say that where the legal materials

(the statutes, the rules, the decisions) have been properly organized and classified, he should be able to pass upon, preliminarily, many of the issues which face him while he is working out a managerial problem. It is only very recently, however, that any effort has been made to organize the legal materials of the public utility industry with which he must work so that even the lawyer, to say nothing of the business man or engineer, might use them efficiently.

But to return to further illustrations. Let us take the case of an engineer engaged in preparing a rate and valuation case for presentation to a commission or court, or preparing a report for use in purchase negotiations or security issuance or underwriting. Almost every step of the way an understanding of public utility law—and, as many engineers and lawyers can testify, often a very sophisticated and up-to-the-minute understanding—is essential. It is difficult to think of a problem of valuation which is not simultaneously both an engineering and a legal problem, i.e., a problem upon which some legal tribunal's conclusion is authoritative.

For example, on what theory may interest during construction be computed, on what items, and over what period? What of the propriety of capitalizing promoters' fees? May index numbers reflecting rises in prices be applied to book costs to account for appreciation, or is an inventory essential? How should particular classes of tangible property or intangible rights be valued—patent rights, gas leases, easements of way, water rights, paving, grade separation costs, and so on? What is an acceptable theory of going value, and how can it be established; are items for cost of training employees, advertising, possibility of municipal purchase, etc., allowable? On what basis should depreciation annuities be accumulated; how, if at all, must functional depreciation be computed; what are acceptable estimates of service life for meters, transmission line towers, underground conduits, etc.; what relation is there between the valuation basis of accumulating a depreciation reserve and the use of the reserve as a measure of accrued depreciation? Here again the list of mixed questions of engineering and of law could be extended almost indefinitely.

Two aspects of the situation

We would find the same situation to obtain if space permitted us to consider the case of others in the ranks of management: the general executives, the financing officers, the "new-business" men, the construction engineers. Confirmation is also contained in the books on the public utility industry written in recent years by leading engineers and administrators. In "Economics of Public Utilities," the work of L. R. Nash, the distinguished chairman of the rate research committee of the N.E.L.A., there is page after page discussing engineering and economic problems which shade off into the law, and pages of discussion of legal problems which merge with engineering and economics. And the same thing is true of other less recent technical books, such as "Public Utility Rates," by Harry Barker; "Public Utility Rate Fixing," by C. E. Grunsky; "Outlines of Public Utility Economics," by Prof. M. G. Glaeser, and others that might be named.

As was said at an earlier point, the managerial and technical personnel of the public utility industry has recognized the necessity for an understanding of those principles of the law which touch and affect the daily activities and the general policies of their business. What of the other side of the medal? Have the lawyers, the legislators and the commissioners (predominantly lawyers), the judges (always lawyers), and "the law" (viewed as an institution), recognized the necessity for understanding the engineering and economic facts which should govern legal conclusions?

The mental habits and processes of a lawyer, it must be said at the outset, differ widely from those of an engineer or any other scientist. Because of the nature of our system of law the lawyer, speaking generally, must reason deductively, from the general principle to the particular case. The scientifically trained engineer, on the other hand, customarily reasons from the particular case to the general rule, and is not always interested in a rule at all! This difference in mental habit, together with his well-known conservatism, has made it difficult for the lawyer to understand the engineering and economic principles and methods inherent in the modern administration of the public utility industry, or even to sense their importance to him and his function. There has been another important contributing factor. The engineering and economic data which form the background against which most problems of public utility law must, or should be decided have until very recently, never been organized and systematized so that the hard-pressed lawyer could make use of them.

Sociology and economics are molding law

Whatever may be true of the lawyers engaged in what is known as "general practice," it is certainly fair to say that the lawyers who form the class of special public utility practitioners or counselors have shown themselves fully alive to the inter-relation between engineering and economics and the law. Such lawyers as William L. Ransom, John H. Roemer, Francis L. Daily, John W. Davis, Frederick H. Wood, Charles Bracelan and Harry J. Dumbaugh, to name but a few, are fully cognizant of the engineering and economic principles which underlie the legal doctrines of which they are masters.

That there is a serious gap between the facts of social and industrial life and the law as administered by legislators, judges, commissioners and lawyers it would be absurd to deny. The rise of a generation of lawyers who are trained not only in the law but also in other social sciences is doing much to close this gap. Nowhere is this proving more effective than in the field of public utility law, where the necessity for considering the facts with which the engineers and the executives deal is more imperative than in any other realm of law.

In a discerning editorial in a recent issue of ELECTRICAL WORLD (February 22, 1930, page 383) this gap between the law and the realities of modern life was commented upon, and the hope expressed that present-day efforts in legal research might lead to a new legal philosophy, in which the contributions of the social scientist and the engineer would be infused into the legal structure. Whatever the outcome, in other fields of law, of this hopeful development, this much can be said with assurance: In the field of public utility regulation, where the lawyer, the economist and the engineer meet on common ground, the closing of the gap is coming rapidly.

Primary Metering Old and New Style

By W. G. KNICKERBOCKER

Assistant Superintendent of Meters, Detroit Edison Company, Detroit, Mich.

SIMPLIFICATION and better appearance of primary meter installations have been achieved on the system of the Detroit Edison Company through the use of the recently introduced bottom-connected polyphase meter. A workmanlike job could be made with the side-connected meter, of course, but the new type permits a saving of wall space and a more compact grouping of the parts of the metering assembly. The simplification is particularly noticeable in those installations where two meters are used with both current and potential transformers; for example, where primary service is offered at 4,800 or 24,000 volts and the rate includes demand and power factor clauses.

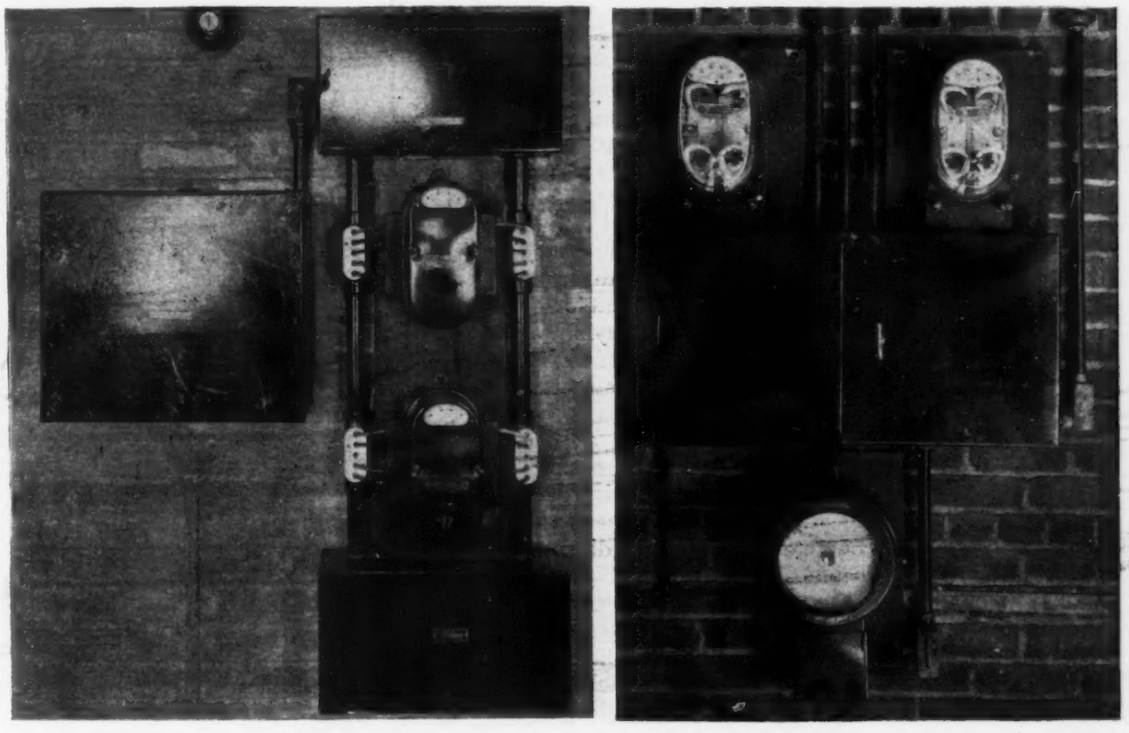
The necessary metering and control equipment for such installations becomes a rather formidable list, viz., two watt-hour meters, demand meter and clock or graphic demand meter, test switch, reactive phasing transformer, reactive test switch, meter test cabinet, two potential transformers, four current transformers, and necessary colored wire, conduit and fittings. All of this equipment is installed in the customer's primary house, as are the oil switches, relays, etc. With the exception of the watt-hour and demand meters, which are set by utility employees, installation and construction work is done by an electrical contractor from plans approved by utility engineers.

Incidentally, ownership of the main oil switches, meters, instrument transformers, control wiring and test equipment is vested in the supply company. The customer owns the circuit oil switches, power transformers, bus structure and related equipment.

The changes in the installation allowed by the bottom-connected meter are shown in the accompanying illustrations. One is of a primary installation using side-connected meters, two sets of current transformers (one set for relay operation and for field checking of the metering current transformers by comparison) and two connection boxes. While this set-up could be mounted and wired to present a neat appearance, a complete new design was undertaken when the bottom-connected meter was introduced. This resulted in the set-up illustrated. The testing equipment includes a combination switch to facilitate meter and relay testing and a combined auto-transformer and test switch, all mounted in a 5x16¼x33-in. steel cabinet with standard openings arranged to take trims for either side- or bottom-connected meters.

Insulating baffles riveted to the box covers act as buffers to close partially open current or potential test switches when the cover is swung shut. It is, therefore, impossible for an inspector to close and seal the box with any switches in an improper operating position. The use of colored wire permits easy checking of connections all the way from transformers to meters and is also easier to install properly in the first instance. Test equipment in use was readily adaptable to the new set-up.

The idea behind the design of the new installation was to devise a flexible arrangement so that either side- or bottom-connected meters could be used—a design that looked well and that could be installed, so far as possible, of standard materials and at minimum cost to both the electric light and power company and the customer.



The old and the new in primary metering

The bottom-connected meter permits compact arrangement of the whole assembly of metering and attendant devices.

Saving $30 per Bay in Wiring of Providence

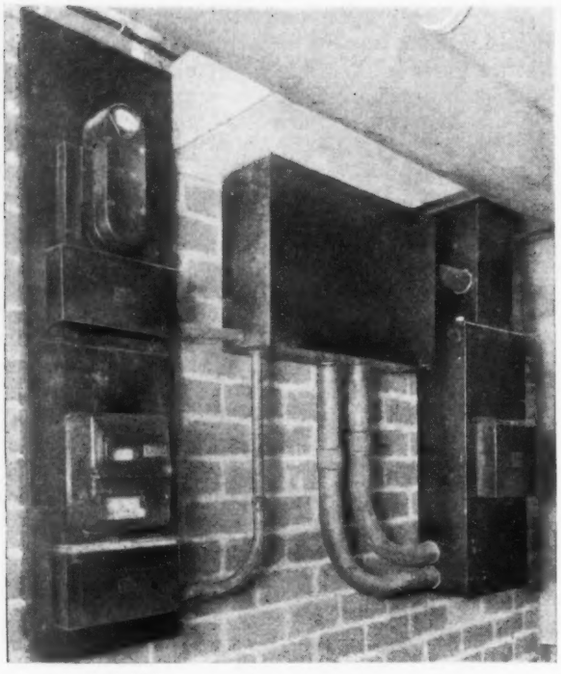


Fig. 1—Main safety switch, junction box and master meter with graphic and recording features control energy supply to building for light and power service

FLEXIBILITY of service and economy in construction governed the design of the electrical installation of the recently completed Produce Terminal Warehouse at Providence, R. I., where the space rented to occupants varies from time to time, with the added requirement of suitable metering and provision for rapid restoration of service in case of interruption. These needs have been met by the use of the three-phase, four-wire distribution system, the employment of small air circuit breakers in place of fuses and a symmetrical layout of service outlets and concealed rigid conduit construction. In the 64 bays into which the structure is divided, the minimum saving in first cost of wiring and circuit protection, involving the illumination of a total floor area of 202,650 sq.ft., is $30 per bay.

The new warehouse is 965 ft. long, 32 ft. high and has two stories and a basement. It was designed as a fireproof and rat-proof concrete and steel building. The connected lighting load is about 195 kw. and the power installation 62 hp., with an ultimate capacity of 300 hp. Elevators and ventilating fans comprise the power service. The building is located near the business center of the city, with ample railroad trackage facilities and provision for motor truck loading and handling. The basement is 90 ft. wide and the two floors above 60 ft. wide each, exclusive of the loading platforms.

The general scheme of connections is shown diagrammatically for the main power circuit and a few typical power and lighting branch feeders. The distribution system furnishes 120 volts between each phase wire and the grounded neutral, which is used for lighting and small power, and the 208 volts between phases is utilized for three-phase power distribution. The supply is taken from the secondaries of a 300-kva., 11,000/120-volt transformer which is energized by a feeder from the Harris Avenue substation of the Narragansett Electric Company.

After passing through a main safety switch the power mains are carried through a current transformer box, from which the secondary leads are connected to the

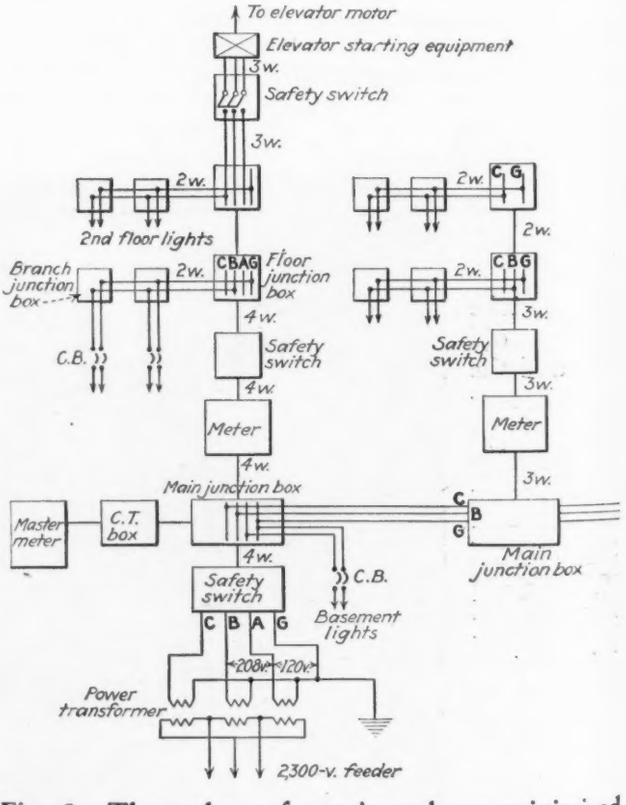


Fig. 2—Three-phase, four-wire scheme minimized material in combined power and lighting service for warehouse

Warehouse

THE use of air circuit breakers and four-wire, three-phase distribution in the new Providence terminal warehouse eliminated branch circuit fusing and reduced the wiring cost materially in this installation. The scheme enabled the designing engineers to provide a flexible and symmetrical layout for the lighting and power service of this multi-bay structure.

LIGHT and power are furnished in combination by utilizing the grounded neutral and a balanced phase for the former and the phase wires of the system for the latter.

master meter. The actual arrangement of the main metering equipment in the basement illustrates the simplicity and compactness of the layout. The switch is rated at 600 amp., for 250 volts a.c., four-pole, single-throw. The mains are taken through a junction box at the top of the switch to the current transformer cabinet, which is 36x24x10 in. The master meter is mounted on a wooden panelboard 27x15 in. and $\frac{7}{8}$ in. thick. The meter is of the integrating type with a demand recording attachment.

After passing through the master meter the mains are carried through a series of main junction boxes, which serve as points of distribution for the various interior power and lighting feeders. These feeders are indicated in the form of risers in Fig. 2, with the individual meters and safety switches provided for each tenant. Basement tunnel lights are taken from the main junction boxes and are controlled by circuit breakers and pull-chain switches.

Referring again to the typical connection diagram, Fig. 2, the riser for a combined power and lighting feeder carries four wires up to the second floor, but only three of these wires continue to the pent houses for the

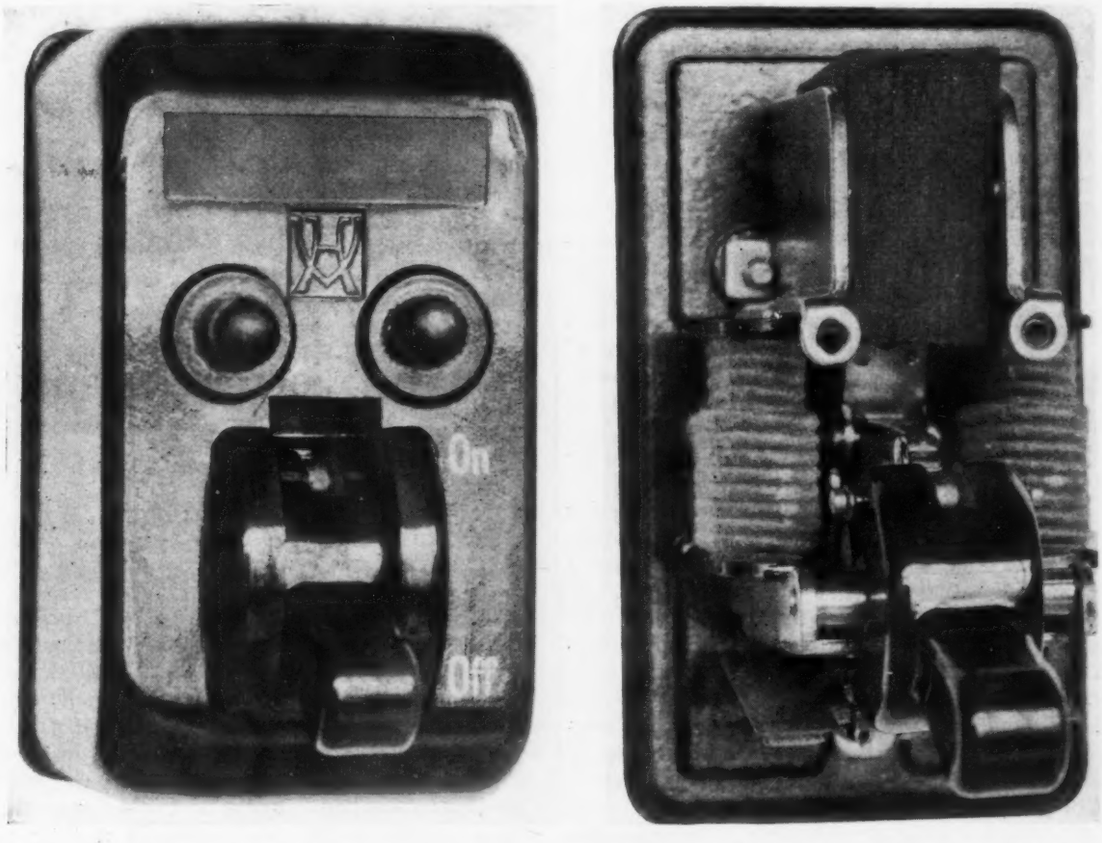


Fig. 3—Front view of air-circuit breaker used instead of fuses and interior switches for branch circuit control

three-phase elevator motors. The branch circuits for the lights and plugs on each floor are tapped through a series of floor and branch junction boxes to the circuit breakers which control each branch or group of outlets.

The lighting feeds for each floor carry only two wires per phase. The phases are balanced by assigning phase A to the basement lighting, phase B to the first floor and phase C to the second floor. In the case of a metered feeder circuit carrying only lighting and convenience outlets, the riser to the first floor contains only three wires, and the feed between the first and second floors requires only two wires.

The total estimated lighting load of 195 kw. allows a reasonable diversity factor for lamp and plug outlets. The drop in voltage between the point of supply and the outlets is kept within safe limits of not more than 5 per cent by the use of large-sized cables for the main feeders to the distributing junction boxes and by running a number of parallel feeders from the distributing points to the floor and branch junction boxes. The mains between some of the distribution boxes are made up of four 400,000 circ.mil cables, rubber covered. This does away with excessive drops through long runs of small wires and helps to improve the voltage regulation.

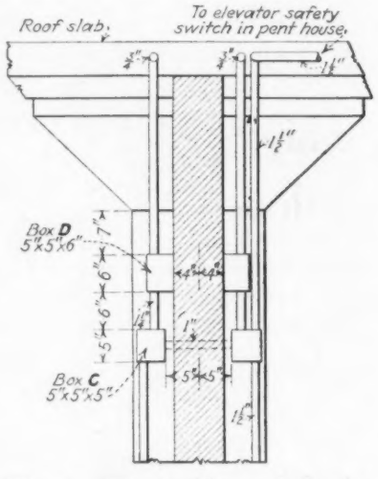


Fig. 4—Typical branch feeder conduit runs to roof

The lighting units on the main floor are designed for 200-watt lamps; on the loading platforms, in the basement and on the second floor the lamps are rated at 100 watts and on the walls, in the stairways and in the toilets 60-watt lamps are used. The first floor lights are furnished with Wheeler type R.L.M. No. 1256 "Durex" reflectors with pull-chain sockets. The platform lights are provided with vapor-proof globes, Wheeler No. S-723 14-in. diameter reflectors and No. 1303 canopies. The basement and second floor lighting units have Wheeler No. 1264 reflectors with pull-chain sockets.

There are at present installed fourteen fans for toilet ventilation. Each fan is driven by a 120-volt, single-phase, 60-cycle, fractional-hp. motor and has a 9-in. blade, exhausting free at the rate of 950 cu.ft. per minute. The fans are so wired that when any toilet light is turned on the fan in that room is started automatically.

The use of the grounded neutral with three-phase leads permitted the supply of single-phase lighting and three-phase power circuits through the same set of mains. The combined power and lighting system was further simplified by a liberal use of 18x8x8-in. junction boxes, even for the main points of distribution, providing ample room for the necessary taps. Smaller boxes used for floor and branch distribution measure 5 in. in each dimension. The boxes are provided with removable covers, making them accessible for repairs and inspection.

Air breakers control branch circuits

An interesting feature of this installation is the use of small air circuit breakers instead of switches and fuses for the control and protection of the branch circuits. These breakers are of a simple and compact design made by the German firm of Voigt & Haeffner, rated for 15 amp. continuous duty. The breaker, for this service, designed for a 250-volt, single-phase circuit, is only about 4 in. high, 2 in. wide and 2½ in. deep. The use of these breakers instead of fuses and switches has proved both economical and reliable in six years of applications by the engineers for this installation.

The economy obtained is due partly to the saving in copper by the use of the three-phase, four-wire system in place of the usual three-wire, single-phase for lighting and a separate three-wire, three-phase circuit for power. This also involved a corresponding saving in a more simplified conduit installation. The use of junction boxes for all connections and of the small air breakers for control and protection of branch circuits permitted the saving in material and labor that would otherwise be required for cut-out boxes and power and lighting cabinets equipped with main and branch switches and fuses. A conservative estimate of these savings totals $1,920 for the 64 bays.

In addition to the economy shown in this installation, this method of distribution gives greater flexibility for additions or changes, since the combined power and lighting feeders are located within easy reach for any floor or bay. To this may be added the operating feature of requiring practically no maintenance except lamp renewals, since in case of an overload or short circuit the air circuit breaker of the circuit affected will automatically trip out, requiring only its reclosing by hand when the cause of the overload is removed.

The installation was designed and the construction was supervised by the engineering firm of Jenks & Ballou, Providence, and the contractor was Gray's Engineering & Electrical Construction Company of the same city.

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Tungsten-Filament Lamps Benefit Seedlings

By M. LUCKIESH
Director Research Laboratory, National Lamp Works, Cleveland

LONG ago mankind began to grow plants indoors in more or less controlled environments, although solar radiation is still depended upon. However, one cannot intimately view this aspect of civilization without concluding that artificial sources of radiation will eventually find many applications in indoor horticulture. Researches are already contributing to the knowledge of the relationships of radiant energy and plant growth, but the construction of this foundation is a long and difficult task.

Recently an interesting use of tungsten-filament lamps

has been suggested by the researches of Prof. V. A. Tiedjens of Massachusetts Agricultural College. Plants, and especially seedlings, decay at or near the surface of the ground as the result of parasitical fungi which destroy the tissue of the stem. This is termed damping-off. By placing 200-watt tungsten-filament lamps in reflectors about 2 ft. above the seedlings the damping-off is satisfactorily controlled when sunlight is insufficient, as it often is excepting in summer. A mixture of half sand and garden soil is used because it affords good drainage and reduces nitrification. This soil, without the lamps, controls the damping-off if sunlight is not reduced too much and the air does not remain too moist, but the lamps are needed after autumn begins. The seedlings become spindly if a rich garden soil is used.

The lamps are turned on as soon as the seed is planted and are not turned off excepting on bright, sunny days. After the cotyledons have unfolded the artificial light may be discontinued if the weather is bright and the surface soil is kept dry. It is preferable, however, to use the lamps until the seedlings are transplanted. With unfavorable growing conditions the potted plants may be exposed to the lamps several hours in the evening until the plants are large enough so that there is no further danger of damping-off. Undoubtedly the building of carbohydrates, followed by a heavier cell-wall, partially accounts for the success of the method. Of course, the heating effect of the lamps makes the conditions less favorable for development of the damping-off fungus.

The lamps have been used to advantage on selections that produce only pistillate flowers during the winter months. These selections may be selfed if the potted seedlings are exposed to the electric light until four or five true leaves are formed. Sufficient staminate flowers will be produced so that the first few pistillate flowers may be self-pollinated. An extra generation can thus be grown for those characters that are not influenced by environment.

Corn and lettuce grown by this method produce sufficient seed for an extra generation. The method has considerable application in northern latitudes where only the vegetative stage of adapted greenhouse plants can be grown during the winter months. Other advantages of the artificial light, in addition to controlling damping-off, are that the soil is warmed so that weak or old seed germinates better in a shorter time, and the germinating can be done in a cool greenhouse without increasing the temperature of the greenhouse.

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Relaying Transformers with Unloaded Delta Tertiaries

By V. J. CISSNA
Electric Bond & Share Company, New York
Electrical Engineering Department.

THE N.E.L.A. relay handbook and the manufacturers' handbooks do not give relay schemes for the protection of transformer banks with unloaded delta tertiaries. The tertiaries of such banks are not connected to external circuits and their purpose is the suppression of harmonics or the supplying of ground current.

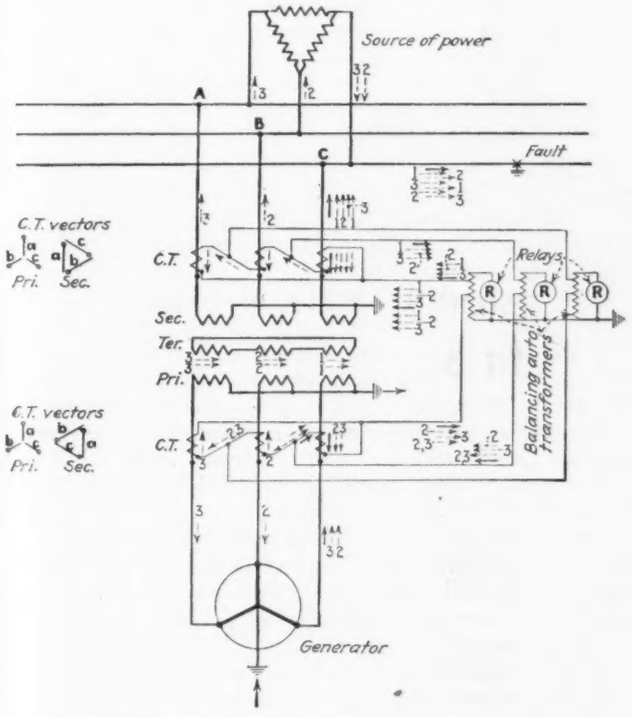


Fig. 1—Differential protection for Y-Y delta-tertiary transformers and neutrals grounded

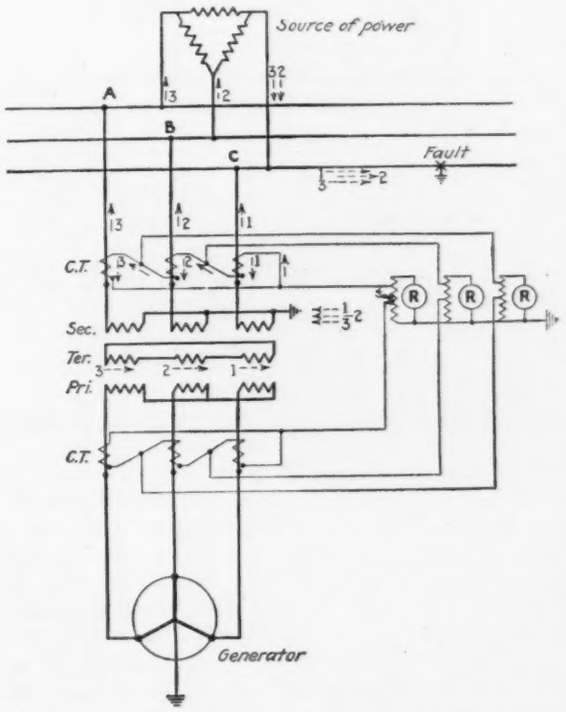
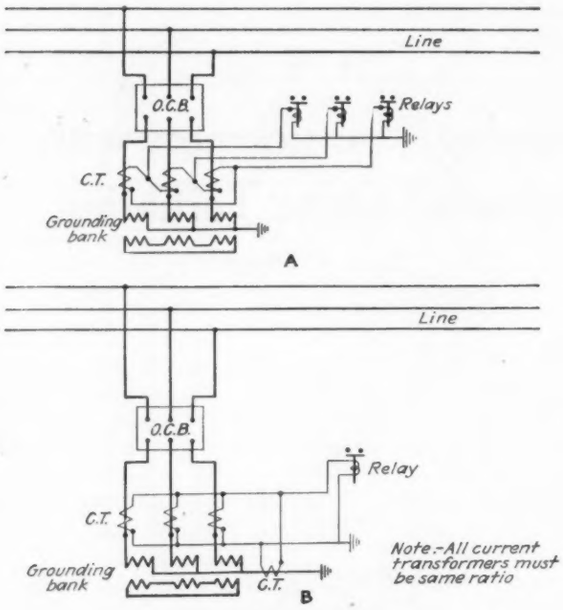


Fig. 2—Current distribution with differential protection on Y-Y delta-tertiary transformer with neutral ungrounded

If the neutral of such a bank is grounded, the tertiary introduces complications in relaying which are sometimes overlooked. The accompanying diagrams illustrate schemes of relaying devised by R. P. Crippen and the author which are applicable to some of the more common transformers with unloaded tertiaries.

The proper connections for differential relays on a *YY* transformer with neutrals grounded and with delta tertiary are shown in Fig. 1. The paths of the various current components for ground faults external to the protective scheme are indicated. It is obvious that the conventional *YY* connection of current transformers would not permit a current balance, whereas balance is possible with the delta connection of current transformers. It will be noted that currents which would cause incorrect relaying with the *YY* connection of current transformers circulate within the delta of the current transformers and do not reach the relay circuit. In order that these currents may circulate within the delta, they must be of equal magnitude and must also be in phase.



Figs. 3 a and b—Differential protection for grounding banks

That the currents are equal and in phase is perhaps seen easier from Fig. 2. With the fault shown, the procedure may be thought of as follows: On the occurrence of the fault, potential across phase *C* of the transformer tends to collapse. The collapse is resisted by the delta tertiary in which a circulating current is set up. This circulating current in turn causes an equivalent current to flow in each winding with which it is linked. Since the currents set up in the *Y* winding by the tertiary are in phase with and equivalent to the circulating current in the tertiary they must be in phase with and equal to each other.

The connections shown in Fig. 1 may be applied to *YY* banks with delta tertiary and with one or both neutrals grounded, and may also be applied to Y-connected auto-transformers with delta tertiary and grounded neutral.

Differential protective schemes for grounding banks are shown in Figs. 3a and 3b. With both schemes the relays will not have current in them due to ground currents and settings can therefore be sensitive. The relays for both schemes should have a slight time delay or, if instantanous, high enough current settings so that they canonot trip when magnetizing the transformer.

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Industrial Plants Need Full Power Service

"WE DON'T want to run a power station," said W. R. Diver, production manager of the Arlington, N. J., plant of the Du Pont Viscoloid Co., Inc., recently, "but we have to do so because otherwise we cannot get the steam that we must have for our processes. We need electrical energy in large quantities and process heat is vital. I suppose that our manufacturing process requires as high a steam use as almost any that you might find, although we are continually reducing it. In 1921 we used 302 lb. per pound of product and in 1928 114 lb. This, of course, includes building heating, air conditioning and generation for part of our electrical requirements. It amounts to some 40,000,000 lb. in each of the winter months.

"Costs, of a certainty, are a predominant element in any consideration of manufacturing problems, but if we could obtain combined electric and steam service of the utmost reliability and at a price that was not out of line with known steam and generating costs, I can say that we would at least be very much interested. I look forward to the day when just this service may be obtained from our utility companies. It is being done more and more. Consider the new Deepwater station of the American Gas & Electric and United Gas Improvement Companies. Here a special provision in station design has been made for the supply of low-pressure process steam to a Du Pont plant from the boilers of this 1,200-lb. pressure station.

"That we should be forced by circumstances to continue to operate a complete power station, including coal handling, steam generating through pulverized fuel-fired boilers, electricity generation, frequent synchronizing of our station with the utility supply which supplements our generation of power, and to maintain all these structures and machines, is not economically sound, nor, in a good management sense, desirable. We want steam. We want electricity. We don't want to pay fancy prices to get a service. But, fundamentally, we are manufacturers of a highly specialized product and running a power station is an unpleasant and, I am sure, ultimately unnecessary venture. I realize that today our utility company cannot give us the service. We are too far from its stations and no steam distribution system has been inaugurated. But complete power service is something well on the way to local availability and it will, in general, be found that the process steam bugaboo is less a 'cost problem' in electricity generation than a distribution problem for a further co-ordinated service."

Men of the Industry

T. E. Roach Assumes Broader Duties

T. E. ROACH has been elected vice-president in charge of the commercial department of the National Electric Power Company and of the National Public Service Corporation, both in New York. Mr. Roach, who has been commercial manager of the National Electric Power Company for five years, began his public utility career in 1912, when he entered the employ of the Union Power & Light Company at Omaha. In 1914 he became purchasing agent for the company, and in 1919, after a period of war service, he was placed in charge of the commercial department. When the Northwestern Public Service Company was formed Mr. Roach was made an assistant general manager, with direct supervision of the merchandise activities of the company. From this position he transferred to the National Electric Power Company in 1925.

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FRANK M. KEMP of Dallas, Tex., has been named a director of the Central & Southwest Utilities Company to fill the vacancy caused by the death of George W. Fry of Abilene.

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JOHN R. MARSH, formerly assistant manager of the public relations department of the Georgia Power Company, has been appointed manager to succeed L. K. Starr, resigned.

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MATTHEW C. BRUSH, president of the American International Corporation, was elected a member of the board of directors of the Engineers Public Service Company to fill the vacancy caused by the death of Dr. Arthur T. Hadley. Mr. Brush is a director of many large industrial and railway corporations and is well known in the financial world.

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R. P. WAGNER, formerly manager of the rate and research division, has been appointed commercial manager New York Power & Light Corporation. In addition to these new duties, Mr. Wagner will continue as head of the rate and research division, with offices at Albany. M. E. SKINNER, whom Mr. Wagner succeeds as commercial manager, has been placed in charge of the merchandising activities of the entire Niagara Hudson System. Mr. Wagner has had a wide experience in the public utility field. Following several years in various positions in Nebraska, he was appointed general superintendent of the Durham Public Service Company in North Carolina, subsequently transferring his interests to the H. L. Doherty company as assistant engineer in St. Joseph, Mo. Three years later Mr. Wagner was appointed rate engineer of the Doherty company and was transferred to New York City, remaining there until 1929, when he joined the New York Power organization at Albany.

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Stanley and Middlemiss Made Vice-Presidents in Birmingham

WELLS M. STANLEY and GEORGE H. MIDDLEMISS have been elected vice-presidents of the Alabama Power Company, according to an announcement made by Thomas W. Martin, president.

W. M. Stanley

Mr. Stanley has worked in almost every department of the company and thus is well equipped to fulfill his new executive duties. He started with the Huntsville, Chattanooga & Birmingham Interurban Railway, Light & Power Company in Huntsville in 1909, remaining there for three years, when he was transferred to Attalla, Ala., as superintendent. Returning in 1914 to the Huntsville property he became manager of that utility, and when the property was purchased by the Alabama Power Company Mr. Stanley was retained as local manager. In 1917 he was transferred to Birmingham and made manager of local operations in that city. He continued in this capacity until 1920, when the northern division was created and he was appointed manager, serving until his appointment in 1925 to the general managership of the Gulf Power Company. He relinquished these duties to become manager of sales of the Alabama Power Company in 1928.

A Californian by birth, Mr. Middlemiss joined the Alabama Power Company in 1917 as superintendent of maintenance. The company was growing rapidly at that time and it was he who first conceived the idea of the divisional organizations, which, as a matter of record, has proved eminently successful. Later he became superintendent of distribution, and in 1925 was elected vice-president of the Southeastern Engineering Company. Mr. Middlemiss' early experience following graduation from the University of California was with the Pacific Gas & Electric Company at

G. H. Middlemiss

Sacramento, where he engaged in designing and constructing the underground distribution system.

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H. M. HAMMOND has been appointed manager of sales and engineering for the Bailey Meter Company. Mr. Hammond's former position with the company was that of sales manager.

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WALLACE A. PRICE, since 1925 manager of the central division of the Central Maine Power Company at Augusta, has been transferred to Bath as manager of the southern division with territory extending east to Wiscasset and south to Freeport and Yarmouth. WILLIAM F. WYMAN, formerly rate engineer and lately district representative at Boothbay Harbor, will become manager of the central division with offices at Augusta.

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W. T. KYLE, formerly sales manager of the Page Steel & Wire Company, New York, has resigned to become president of the Welding Engineering & Research Corporation with offices in New York City and engineering and research laboratories in Long Island City. The Welding Engineering & Research Corporation has been organized to co-operate with industry in the safe and economical application of welding and cutting of metals.

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W. H. BARNWELL has been appointed industrial agent and head of the industrial department of the Georgia Power Company. Mr. Barnwell became associated with the company February 1, 1929, as industrial representative. He entered the electrical industry as superintendent of the light plant at Yorkville, S. C., and later was connected with the electrical department of the Southeastern Underwriters Association. He served as Atlanta representative of Lockwood, Greene & Company before joining the Georgia Power Company early last year.

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CHARLES E. HARTHAN, engineer and inventor, retired May 15 after 45 years of continuous service with the General Electric Company. Mr. Harthan began as a machinist with the old Thomson-Houston Company, was transferred within a year to the model room to work under Professor Thomson himself and continued in that service nine years. Mr. Harthan's greatest contribution, perhaps, was in the field of arc and street lighting, and in this and related branches of engineering he devised about 50 improvements of various kinds on which he was granted patents. Mr. Harthan was born in Worcester in 1864 and was graduated from the Worcester Polytechnic Institute in 1885.

Herbert M. Patton Heads Missouri Association

HERBERT M. PATTON of St. Louis was elected president of the Missouri Association of Public Utilities at the recent convention held at Springfield to succeed Major T. J. Strickler of Kansas City. Mr. Patton, after graduating in 1907 from the engineering department of Washington University in St. Louis, spent several years in the operating department of the Republic Iron & Steel Company at Moline, Ill., Toledo, Ohio, and East St. Louis, Ill. In 1913 he became connected with the Light & Development Company of St. Louis, and at the time of its sale to the Union Electric Light & Power Company of St.

Louis he was its purchasing agent and also manager of its subsidiary company, the Western Power & Light Company of St. Louis County. Since 1923 Mr. Patton has been with the Union Electric Light & Power Company and is now superintendent of the outlying districts department of that company.

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T. P. PFEIFFER has been appointed advertising manager of the Byllesby Engineering & Management Corporation and Standard Gas & Electric Company.

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WILLIAM P. CREAGER, chief engineer of the Power Corporation of New York, arrived in Watertown, N. Y., May 16 after a two months' trip to Russia, where he made a survey for the Soviet government on its fifty-million-dollar project to develop hydro-electric power and generate electricity on the Svir River in that country. Mr. Creager's work in Russia entailed a thorough examination of the river and recommending to the Soviet government the most efficient methods of proceeding with the work of laying the foundation for the dam and power house. Mr. Creager states that Russia is making great strides in the scientific exploitation of its latent possibilities.

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G. J. HAYS has been appointed underground engineer for the Dallas Power & Light Company, Dallas, Tex., upon the resignation of H. H. Robison, formerly head of the underground division. Mr. Hays is a graduate engineer, having received his B.S. degree in electrical engineering from the University of Texas in 1921, and has been in the employ of the underground division for the past 7½ years, the last four of which he served as assistant underground engineer.

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M. H. FRANK, formerly manager of the eastern division of the Wisconsin Power & Light Company, has been appointed to the newly created position of assistant to G. C. Neff, vice-president and general manager of the company, with headquarters at Madison. Mr. Frank was recently elected president of the Wisconsin Utilities Association.

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JOHN WILSON MCNAIR, formerly of the standards department of the American Institute of Electrical Engineers, and CLARENCE EDWARD DARLING, formerly of the staff of the American Society of Mechanical Engineers, have joined the staff of the American Standards Association. Mr. McNair will devote most of his efforts to electrical standardization projects. Before joining the staff of the American Institute of Electrical Engineers he was connected with the National Electric Light Association and with the United Electric Light & Power Company. Mr. Darling has had considerable experience in the field of mechanical standards as a member of the staff of the American Society of Mechanical Engineers. He has also been connected with the Public Service Corporation of New Jersey. He will handle especially mechanical and chemical projects.

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OBITUARY

PROF. DR. ERNST GUMLICH, for many years head of the German State Physical-Technical Institute and a leading German authority on electrical measurements, died recently in Berlin in his seventy-first year.

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JOHN H. PAPE, since 1920 district manager in Berkeley, Calif., for the East Bay division of the Pacific Gas & Electric Company, died in that city May 4 as the result of a heart attack. He had been associated with the power company since 1893.

Financial and Statistical News

EFFECTS of easy credit conditions are already evident in power and light financing figures. For the first four months $45,000,000 of bonds were sold at a yield under 5 per cent, against $25,000,000 for the entire year 1929. Yields in general, however, have not been radically reduced.

——POWER AND LIGHT FINANCING for the first four months of this year, excluding rights and customer sales, totaled $431,000,000, against $446,000,000 for same period last year.

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Georgia Companies to Merge

STOCKHOLDERS OF THE Columbus Electric & Power Company will vote at a special meeting called for May 26 on a plan involving the consolidation of that company with the Georgia Power Company, the consolidated company to be called the Georgia Power Company. The agreement of consolidation provides that for each share of preferred stock, series B, of the Columbus utility the consolidated company will issue one and one-sixth shares of its $6 preferred stock; for each share of preferred stock, series C, the consolidated company will issue one and one-twelfth shares of its $6 preferred stock; for each share of preferred stock, series D, one share of its $6 preferred stock, and for each share of second preferred stock one and one-sixth shares of its $6 preferred stock. For each share of the common stock of Columbus Electric & Power the consolidated company will issue nine-tenths of a share of its $6 preferred stock. The acquisition of the Columbus Electric & Power Company by the Southeastern Power & Light System was announced in the August 24, 1929, issue of the ELECTRICAL WORLD.

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Columbia Gas Directors Approve United Offer

COLUMBIA GAS & ELECTRIC DIRECTORS have approved the sale to United Corporation of about 25 per cent of Columbia Gas & Electric common stock on an exchange basis.

The United Corporation had offered to acquire a block of approximately 25 per cent of common stock of the Columbia Gas & Electric Corporation on the basis of one-third of a share of $3 preference stock, bearing cumulative dividends from July 1, 1930, and 1½ shares of common stock of the United Corporation for each share of common stock of Columbia Gas & Electric Corporation, without the special dividend in voting trust certificates representing shares of common stock of Columbia Oil & Gasoline Corporation which had been declared payable to stockholders of record May 24, 1930.

The United Corporation states that if the plan is consummated it intends to pay a dividend of 50 cents a share on its common stock in October, 1930. This, with the regular dividend on the preference stock payable October 1, 1930, will mean that there will be paid in the second half of this year on each unit of United Corporation stock an aggregate of $1, which is equivalent to the $1 dividend payable on each share of Columbia Gas & Electric Corporation stock during the same period.

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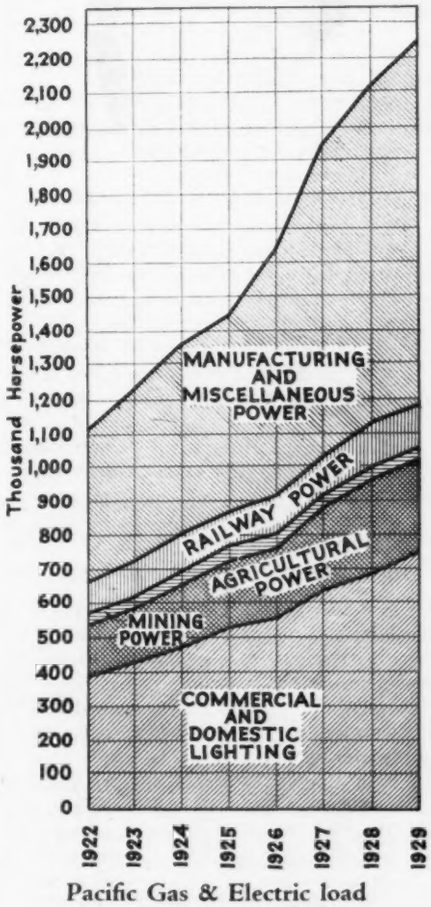
Operating Costs Cut 15 per Cent in Five Years



Pacific Gas & Electric load is widely diversified

RIGID reduction of operating costs has enabled the Pacific Gas & Electric Company to show an 11.8 per cent growth in net earnings, while gross revenue increased by only 4.8 per cent. The operating ratio has been lowered steadily from 56 per cent in 1924 to 41 per cent last year, a record few companies can duplicate.

This 4.8 per cent rise in gross revenue is considerably under the average increase for the industry as a whole, but it must be considered in conjunction with substantial rate reductions. Furthermore, electric revenue taken alone increased 7.6 per cent for the year. Sales for commercial and residential heating and cooking increased 30.1 per cent; commercial and residential lighting 12.2; street lighting 18.7 per cent.

Ten years' growth

	Per Cent
Gross operating revenue	148.44
Sales of electricity, kw.-hr.	195.95
Sales of gas (cu.ft.)	125.09
Consumers	99.48

The company's surplus shows a steady, substantial growth to $15,740,486 last year, having doubled since 1925. Balance of $10,899,921 remaining after payment of preferred dividends was equal to $3.52 per share on the average number of common shares outstanding during the year.

Three issues of rights were offered stockholders during the year and subscriptions up to the end of the year on

these totaled $22,599,933, or approximately 100 per cent of the offering.

The growth of Pacific Gas & Electric Company during the past decade was as shown in the accompanying table.

NEWS BRIEFS

Three relatively small bond issues of subsidiaries of the Pacific Gas & Electric Company mature during the current year. The first mortgage 5 per cent bonds of the Valley Counties Power Company matured on May 1, 1930, and are now being paid off as presented. Two issues mature September 1, 1930, namely, the Bay Counties Power Company first mortgage 5s and Pacific Gas Improvement Company 4 per cent bonds. The aggregate of these three issues outstanding was originally $5,855,000, of which only $1,047,000 remains to be retired at maturity, upward of four-fifths of the bonds having been retired through sinking fund operations during the past 30 years.

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Directors of the Central Public Service Corporation have authorized the issuance and sale of an additional 100,000 shares of $4 cumulative preferred stock to be sold throughout the territories served by subsidiaries.

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Engineers Public Service Company has discontinued the policy of paying stock dividends on the common. The common stock was placed on a $2.40 annual cash dividend basis by the declaration of a quarterly cash dividend of 60 cents per share payable July 1, 1930, to holders of record June 17. Previously the company paid on the common stock quarterly dividends of 25 cents per share and semi-annual stock dividends of 2 per cent.

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Dividend rate on the common stock of the Saranac River Power Company has been increased to $1.50 a share annually from $1, payments to be made quarterly on the first of July, October, January and April.

Power Industry Gains in March

AS ANTICIPATED in the statement published in the ELECTRICAL WORLD of May 3, on the basis of partial returns then in hand, the revenue of the electric light and power industry in March was about 4 per cent greater than in March of last year, the total being $177,100,000. Operating expenses rose by a slightly smaller percentage to $77,680,000, while energy output, with an increase approaching 2 per cent, was 7,652,680,000 kw.-hr. These figures are subject to slight corrections when reports now missing are included.

The significant fact is that in a period marked by decreased operations in many industries the sales of energy continue to grow; temporary local recessions are more than balanced by advances elsewhere; each month breaks all previous records, if normal seasonal variations are taken into account. Thus the revenue for March not only exceeded that for the corresponding month in 1929 by a fair margin but rose 12 per cent higher than in 1928.

About the only unfavorable comparison that can be made is to contrast the actual operations with the estimated normals based on the observed growth during recent years. The average daily revenue in March was $5,720,000, 5 per cent less than the normal, which would have been $6,028,000; the average daily energy output, 247,000,000 kw.-hr., was 8 per cent less than the normal, estimated at 269,000,000 kw.-hr., as shown by the chart. The daily averages are smaller than those for February, in accordance with the usual seasonal change, but total output rose 6 per cent.

The statistics indicate that at present the residential load is growing faster than the commercial.

Hydro-electric energy, after a period of subnormal output, rose to 40 per cent of the total and furnished most of the increase compared with March, 1929; though there was a slight gain in the fuel-generated energy, less coal was burned, and somewhat less oil (Table II).

Fair gains in Northeast and prairie states, not so good in East Central

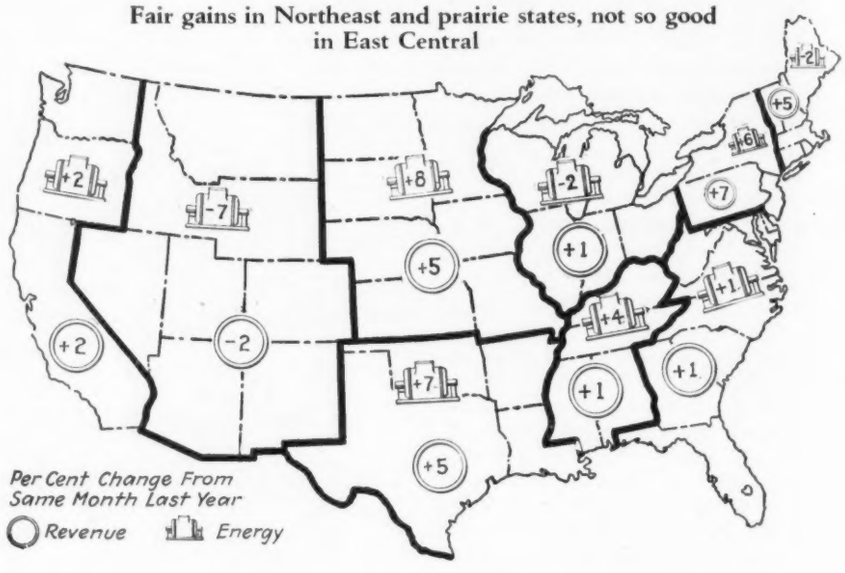


Table I—Central-Station Financial Operations in the United States[1]

Compared with Corresponding Month of Previous Year

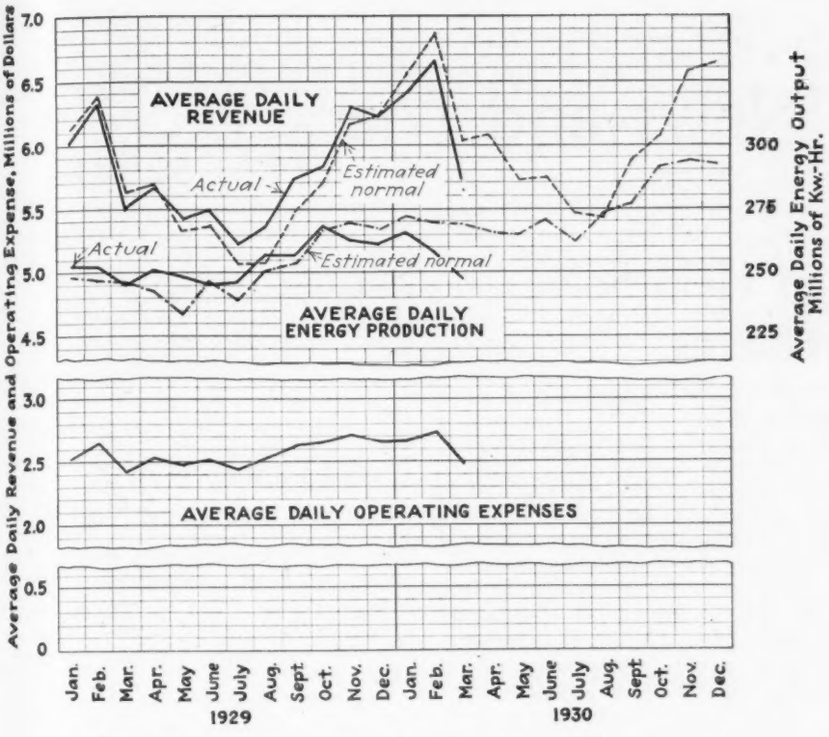
Month	Total Gross Revenue from Sale of Energy*			Total Operating and Maintenance Expense†		
	1929 Thousands	1928 Thousands	Per Cent Inc.	1929 Thousands	1928 Thousands	Per Cent Inc.
December..	$192,200	$180,400	+6.6	$82,680	$77,300	+6.9
1930		1929		1930	1929	
January....	198,300	187,000	+6.0	81,480	77,800	+4.7
February...	186,100	176,800	+5.2	77,300	74,400	+3.8
March.....	177,100	170,500	+3.9	77,680	75,000	+3.6

Table II—Central-Station Fuel Consumption in the United States‡

Compared with Corresponding Month of Previous Year

Month 1929	Coal		Oil		Gas	
	Short Tons	Per Cent Increase	Barrels	Per Cent Increase	Thousands Cubic Feet	Per Cent Increase
December.....	3,708,898	+4.8	1,076,607	+32.3	10,007,930	+40.6
1930						
January.....	3,686,525	—2.9	1,070,777	+17.7	9,807,514	+23.7
February.....	3,133,417	—7.5	830,363	—18.9	9,184,431	+27.5
March.....	3,150,796	—3.9	586,710	— 1.4	9,258,193	+18.6

*Aggregate gross revenue from consumers and from other utilities for energy for resale, involving a certain amount of duplication.
†Do not include interest, taxes, depreciation or sinking fund, with some unavoidable exceptions. ‡As collected by U. S. Geological Survey.
(1) The financial statistics have been revised as explained on page 665 of the issue of March 29, 1930.



Operations above any previous year's, but below normal

The largest gain in revenue, 7 per cent, occurred in the Middle Atlantic States; New England and the West Central groups also exceeded the average for the country as a whole (Table IV and map), while in the eastern Mississippi Valley region the revenue was only slightly greater than last year. Energy gains were similarly distributed, except that New England lost; losses were reported also in the East North Central and Mountain States. To summarize, the most favorable conditions exist in the commercial areas of the East and the agricultural West; the least favorable in the manufacturing districts of the upper Mississippi Valley and the western mining country.

Table III—Energy Output of Central Stations in the United States

Compared with Corresponding Month of Previous Year

Month 1929	Generated, Thousands of Kw.-Hr.*						Purchased for Resale	
	Total		Hydro		Fuel			
	Generated	Per Cent Inc.	Generated	Per Cent Inc.	Generated	Per Cent Inc.	Thous. Kw.-Hr.	Per Cent Inc.
December	8,110,989	+8.0	2,696,365	0.0	5,414,624	+12.5	1,840.000	+13.8
1930								
January	8,239,317	+6.6	2,875,640	+12.7	5,362,677	+ 3.5	1,770,000	+17.1
February	7,181,789	+2.8	2,580,898	+11.0	4,600,891	+ 1.2	1,567,000	+ 5.5
March	7,652,680	+1.9	3,076,218	+ 3.2	4,576,462	+ 1.1	1,722,000	+16.0

Table IV—Regional Operations, Revenue and Energy Output in March, 1930

Compared with Corresponding Month of Previous Year

Region	Estimated Revenue[1]		Energy Generated, Thousands of Kw.-Hr.*					
			Total		Hydro		Fuel	
	Thousands of Dollars	Per Cent Inc.	Generated	Per Cent Inc.	Generated	Per Cent Inc.	Generated	Per Cent Inc.
United States	177,100	+3.9	7,652,680	+1.9	3,076,218	+ 3.2	4,576,462	+ 1.1
New England	17,720	+4.7	498,870	—1.7	238,726	+12.2	260,144	—11.8
Middle Atlantic	47,340	+7.2	1,813,409	+6.0	583,066	+ 7.7	1,230,343	+ 5.2
East North Central	44,740	+0.6	1,894,499	—1.7	225,599	— 4.8	1,668,900	— 1.2
West North Central	14,340	+5.0	449,892	+8.1	125,663	— 3.2	324,229	+13.2
South Atlantic	19,130	+1.1	1,077,147	+1.3	684,160	+ 2.0	392,987	0
East South Central	5,890	+0.5	296,405	+4.0	229,737	+ 4.9	66,668	+ 1.1
West South Central	9,140	+5.1	396,696	+6.8	6,440	—23.6	390,256	+ 7.5
Mountain	4,090	—2.3	286,667	—6.6	242,514	— 6.9	44,153	— 4.7
Pacific	14,710	+1.5	939,095	+2.1	740,313	+ 5.4	198,782	— 8.5

*As collected by U. S. Geological Survey.
(1) The revision of the statistics on revenue is discussed in the issue of March 29, 1930, on page 665.

United Corporation Has New Directors

THE BOARD OF DIRECTORS of United Corporation has been increased by the addition of the executive heads of five corporations in which United is largely interested.

Messrs. Floyd L. Carlisle, B. C. Cobb, Philip G. Gossler, Thomas N. McCarter and John E. Zimmermann were elected to the board, increasing the directorate to ten members from the original five. These are, respectively, the heads of the following organizations: Niagara Hudson Power, Commonwealth & Southern, Columbia Gas & Electric, Public Service Corporation of New Jersey and United Gas Improvement.

Other directors of the United Corporation are Thomas S. Gates, George H. Howard, Alfred L. Loomis, Landon K. Thorne and George Whitney.

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National Power & Light Makes Two New Offerings

NATIONAL POWER & LIGHT COMPANY issued 5 per cent gold debentures, series B, to the amount of $15,000,000, the price being 91 and accrued interest, to yield about 5.50 per cent. These securities, dated May 1, 1930, will mature May 1, 2030. The company also made an offering of 150,000 shares of cumulative $6 preferred stock at 101½ and accrued dividend to yield about 5.90 per cent. Proceeds from the sale of this stock and from the debentures will provide funds for the retirement of all the company's $7 preferred stock outstanding and for other corporate purposes.

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Recent Listings

NEW YORK STOCK EXCHANGE has authorized the listing of first mortgage 6½ per cent sinking fund gold bonds of the Electric Power Corporation, Germany, to the amount of $5,000,000 and of first mortgage gold bonds, series D, of the Metropolitan Edison Company to the amount of $22,594,000.

Recently the New York Stock Exchange authorized the listing of 1,309,713 shares of common stock (no par) of the Blaw-Knox Company with authority to add on official notice of issue three additional shares of common stock (no par) in exchange for one share of common stock of the company of $25 par value issued and outstanding, eleven additional shares of common stock in exchange for stock of Union Steel Casting Company and 12,668 additional shares of common stock authorized for issuance under an employees' purchase plan, making the total amount applied for 1,322,395 shares.

Business News and Markets

Equipment Salesmen Help Solve Utilities' Problems

By E. H. WADDINGTON
District Sales Manager Graybar Electric Company, Kansas City, Mo.

THE very rapid change in the larger electrical manufacturers' merchandising policy is having a very marked effect on the entire electrical wholesale business in our country. I assume that the development and expansion of these companies along distribution lines is primarily to promote the sale and distribution of their own manufactured lines. Centralized buying has been one of the things that has brought about this condition; the fact that requisitions originate in the field properties and are sent to a general purchasing department, where they are frequently handled in a routine manner, has had a great deal to do with bringing about this change. It is not only necessary for electrical wholesalers to establish and maintain close contacts with your employees in the field, but they must contact many different individuals in your engineering, financial, operating, construction and merchandising departments in order to secure the maximum results in your purchases. This plan also works to your advantage.

Study of requirements

Careful study has been given to the very decided difference in the character of your purchases. First, there is "maintenance equipment" or material that is used in your own plants and distributing systems. On practically all of this class of material your specifications and requisitions are very clear and definite when they reach your purchasing department. Salesmen—real service salesmen—keep very close to the new developments, to "the progress in the art," and often are in a position to offer useful and helpful suggestions about some new item or application which may not have cleared through your engineering or operating departments; sometimes these suggestions precede the press or magazine notices and contribute to improvement or economy. There is only a small difference between a profitable and a losing operation in the utility business. Necessarily, much depends upon the ability and experience of the manufacturer or distributor of electrical materials in doing a constructive selling job with the individual or individuals who write these requisitions or specifications. That is one of the things that has brought about the so-called "sales engineer."

Secondly, there is merchandise which you purchase for resale. Again it is very essential and necessary that the men in the field are sold on each specific line of merchandise, its quality and its salability, as they are responsible for the moving of this material after it is in your stock, and it is logical that they should have considerable to say in deciding just what line of merchandise they will and can handle.

The day of so-called "high-pressure" methods in the sale of merchandise is passing very rapidly. Every effort is made today by electrical wholesalers' representatives to have a sympathetic, accurate knowledge of your problems in order to do a constructive job in the relationship between their company and your own. The interest and responsibility of the electrical wholesaler does not end when the order is secured. It is not completed until the merchandise is in the hands of your customers and giving satisfactory service.

In closing, may I suggest that you consider the "salesman who comes to your office" as your friend, rather than "just another peddler." Very often he has opportunities to do you and your company real favors. Even if you cannot use his goods, you can send him away feeling kindly toward you and your company. Neither a public utility nor an individual can have too many friends and your tolerant and sympathetic attitude to the men who call on you may be of great value to you. In this day and age you are justified in using every available helpful measure in the operation of your business. The knowledge, understanding and co-operation of the electrical wholesaler and his entire organization are constantly at your service. Use them.

**From an address before the annual state convention, Missouri Association of Public Utilities, Springfield.*

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Allis-Chalmers Group Insurance Plan

WHAT IS SAID TO BE the largest life insurance contract ever written in the state of Wisconsin is the group insurance plan of the Allis-Chalmers Manufacturing Company for a total of about $20,000,000.

Under the plan those employees who have been with the company at least three months will each participate in $2,000 group life insurance payable at death from any cause whatever. Employees will also have a total and permanent disability privilege, payable monthly for five years. Supervisory employees will receive larger units of insurance, depending upon their positions with the company.

This policy is written on a co-operative basis whereby the employees as well as the company contribute.

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Canadian Tariff Involves Greater Competition Here

GREATER COMPETITION FROM THE UNITED KINGDOM may be expected as a result of Canada's new tariff on machinery, which became effective May 2. Although rates generally appear lower, thus evidencing the Dominion's intention of relaxing this handicap on her industrial developments, some rates have been raised and the preference in favor of British goods increased. As a large proportion of the machinery imported into Canada is unclassified the most important changes in the machinery schedule are in the basket items. Heretofore such machinery, engines and boilers and manufactures of iron and steel, have been dutiable at 15 per cent, 25 per cent and 27½ per cent under the British preferential, intermediate and general tariff respectively. While the general rates to which imports from the United States are subject have been reduced 20 per cent on the machinery of the kind not made in Canada, the

British preferential rate of 15 per cent has been discontinued, thus increasing the differential against American machinery 12½ to 20 per cent.

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TRADE BRIEFS

General Electric Company has been given the order for the two turbo-generators to be installed at the Hudson Avenue station of the Brooklyn Edison Company. The generators will have a capacity of 215,000 hp. each and will cost $18,000,000.

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The Bryant Electric Company, Bridgeport, Conn., has appointed William J. Weaver general sales manager to succeed Robert M. Eames, who was appointed general manager of the company a short time ago. Mr. Weaver, who has been connected with the Bryant company for the past five years, has twenty years' experience in the electrical appliance field. He was formerly connected with the Mount Hope Electric Company, Fall River, Mass.

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Westinghouse Electric & Manufacturing Company has been awarded the order covering the electrical equipment for the two sectional paper machine drives of the new paper mill now being constructed at Bucksport, Me., by the Maine Seaboard Paper Company, a subsidiary of the New England Public Service Corporation.

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L. E. Knott Apparatus Company, Cambridge, Mass., for many years manufacturer of scientific instruments in the Boston district, is to be acquired shortly by the Central Scientific Company of Chicago, a larger manufacturer of such products. Papers have been signed and the transfer of plant is soon to follow. The Cambridge factory is to be operated as the eastern division of the Central organization.

The Ten Commandments of Business Organization

By COL. M. C. RORTY

*Vice-President International Telephone & Telegraph Company**

1. Definite and clean-cut responsibilities should be assigned to each executive.

2. Responsibility should always be coupled with corresponding authority.

3. No change should be made in the scope or responsibilities of a position without a definite understanding to that effect on the part of all persons concerned.

4. No officer or employee occupying a single position in the organization should be subject to definite orders from more than one source.

5. Orders should never be given to subordinates over the head of a responsible officer. Rather than do this the officer in question should be supplanted.

6. Criticism of subordinates should, whenever possible, be made privately, and in no case should a subordinate be criticised in the presence of officers or employees of equal or lower rank.

7. No dispute or difference between officers or employees as to authority or responsibilities should be considered too trivial for prompt and careful adjudication.

8. Promotions, wage changes and disciplinary action should always be approved by the officer immediately superior to the one directly responsible.

9. No officer or employee should ever be required, or expected, to be at the same time an assistant to, and critic of, another.

10. Any officer whose work is subject to regular inspection should, wherever practicable, be given the assistance and facilities necessary to enable him to maintain an independent check of the quality of his work.

**From an address before spring convention American Management Association, New York, May 12.*

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DELINQUENT ELECTRICAL ACCOUNTS

(National Electrical Credit Association)

Number of Accounts Reported

Division	April 1929	April 1930	Per Cent Increase or Decrease	Four Months 1929	Four Months 1930	Per Cent Increase or Decrease
New York	285	331	+16.1	968	1,322	+36.0
Middle and Southern Atlantic	150	174	+16.0	591	801	+35.5
New England	207	181	—12.5	665	566	—14.8
Central	637	807	+26.7	2,571	3,281	+27.6
Total	1,279	1,493	+16.7	4,795	5,970	+24.5

Total Amounts Reported

	April 1929	April 1930	Per Cent Increase or Decrease	Four Months 1929	Four Months 1930	Per Cent Increase or Decrease
New York	$63,928	$51,843	—18.8	$198,180	$237,540	+19.9
Middle and Southern Atlantic	18,761	26,071	+39.0	81,518	118,414	+45.3
New England	22,656	24,670	+ 8.8	84,508	87,337	+ 3.4
Central	94,604	100,988	+ 6.7	328,237	469,768	+43.1
Total	$199,949	$203,572	+ 1.8	$692,443	$913,059	+31.9

Copper for Export in Active Demand

HEAVY SALES OF COPPER for export featured the metal markets in the last week, foreign consumers buying their full allotment every day. The domestic demand quieted down greatly, to the proportions of an average week, after the excited market of a week ago, and the price now seems fairly well stabilized at the 13-cent, delivered, level. Demand for the other major non-ferrous metals was below normal, with current prices lower than a week ago for lead, silver and tin, the last named on Tuesday selling at a new low since 1922. Zinc, however, so far shows no disposition to drop below 4.60 cents. With the exception of last Thursday, the major portion of the week's sales have been at the 13-cent level.

	May 14, 1930 Cents per Pound	May 21, 1930 Cents per Pound
Copper, electrolytic	13	13
Lead, Am. S. & R. price	5.60	5.50
Antimony	7½	7½
Nickel, ingot	35	35
Zinc, spots	4.95	5.00
Tin, straits	33⅛	32⅝
Aluminum, 99 per cent.	24.30	24.30

Market Conditions

IMPROVEMENT in equipment business for the first time in weeks is noted in the Eastern district. Small business is off, but large orders are increasing. Heavy equipment orders are few in New England, but scheduled materials are active.

——INCREASED PRICE AND DEMAND FOR COPPER is a stabilizing factor in the Middle West.

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PACIFIC COAST

—BUSINESS IN STAPLE LINES *seems to be merely marking time and buying is largely for stock maintenance. Building is only fair, though architects claim their racks are full of prints and plans awaiting the owners' release.*

Special business is good, including such outstanding items as Westinghouse switchboards and panels for the Long Beach auditorium valued at $40,000, locomotives for Salt Lake district valued at $50,000 and $115,000 worth of Westinghouse circuit breakers and switchboards for a Puget Sound bridging and dredging company. Other interesting orders cover a carload each of bare copper and weatherproof wire and high-tension insulators for central California installation, $3,500 worth of line material for San Francisco's water department, a carload of crossarms and four carloads of poles for a telegraph company, $1,200 worth of deadends for Fresno, a 10-mile telephone line for the Eureka district and good mixed buying from railroads and the state.

Major construction announced includes a $1,000,000 auditorium for Pasadena, $400,000 hospitals for Los Angeles and Palo Alto, a $1,000,000 courthouse for Beverly Hills, a $500,000 school for Los Angeles and a $900,000 school construction for Honolulu. Westinghouse ranges totaling $10,000 were bought by a Seattle jobber and $40,000 worth in Spokane. Prices are steadier, except for leaded cables, which dropped sharply, about 20 per cent.

Board of Public Works, Seattle, is taking bids until May 31 for about $75,000 worth of miscellaneous apparatus, including four 37,000-volt oil circuit breakers, thirteen 2,000-kva. transformers and three 4,000-kva. auto-transformers and has opened bids for 125,000 lb. of weatherproof, triple-braid, soft-drawn solid copper wire and 80,000 ft. of Siemens-Martin galvanized guy wire.

The Board of Contracts and Awards, Tacoma, on May 19 opened bids for approximately $28,000 worth of equipment for steam plant auxiliary No. 2, including voltage regulators, feedwater heaters, boiler feed pumps, etc., and is taking bids for a structural steel tower, at Cushman hydro-electric plant. Puget Sound Power & Light Company has awarded contract for switchboard and switching apparatus for Bremerton substation, costing about $15,000, and has opened bids for a $45,000 station. Apparatus sales reported last week include about $4,000 worth of miscellaneous switchgear to Puget Sound central stations and motor sales included about 25 from 30 hp. down to pulp and paper mills and approximately 35 from 50 hp. down for irrigation, sawmills and dealers.

The city of Portland authorized call for bids for installation of cables and bases for future ornamental lighting system on Union Avenue, costing in excess of $33,000.

CONSTRUCTION PROJECTS

Glendale, Sacramento and Yucaipa plan ornamental lighting systems. Eugene, Ore., will take bids in July for steam-operated electric power plant to cost $370,000. Butte, Mont., plans installation of beacon lamps for airport. Pacific States Cast Iron Pipe Company, Ironton, Utah, plans addition to plant, reported to cost about $100,000. Salt Lake City, Utah, will install ornamental lighting system.

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SOUTHEAST

—SALES ACTIVITIES IN THE *Southeast held their own last week, though the main volume of purchases are being made by central stations, the industrial situation being quiet.*

Movement in wire and cable featured past week's activities, one company alone buying 30,000 ft. of 19,000-volt lead-covered, paper-insulated cable, 90,000 ft. of 600-volt, lead-covered, paper-insulated cable and 750,000 ft. of aluminum cable. One manufacturer reported the receipt of orders for three cars of weatherproof copper from an Alabama company and one car each from Florida and South Carolina companies. Small municipalities were also buying wire and one jobber reports that his orders last week from small Georgia towns aggregated $18,000. A Georgia company ordered $10,000 in clamps and insulators, while a Tennessee company purchased voltage regulators totaling $7,000. Some other central station orders were for $4,000 worth of distribution transformers and $3,000 of creosoted pine poles. An industrial in the Birmingham district ordered a motor-generator set costing approximately $15,000 and a $6,000 control equipment order is in prospect this week from a North Georgia textile mill electrification job.

CONSTRUCTION PROJECTS

Appalachian Electric Power Company, Roanoke, Va., plans extensions in transmission lines at Rockymount, Va., and vicinity, including substations. Industrial Rayon Corporation, Cleveland, Ohio, contemplates addition to rayon mill at Covington, Va., to cost $1,000,000. Department of Agriculture, Washington, D. C., will receive bids until May 27 for one transformer for Rosslyn, Va. Jackson, Tenn., will receive bids until May 28 for two 2,000-kw. turbo-generator units and other equipment for municipal power plant. Mississippi Power & Light Company, Jackson, Miss., plans transmission line from Meadville to Roxie, Miss., and vicinity.

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NEW ENGLAND

—ORDERS FOR SCHEDULED MATERIALS *are being received in good volume; line material orders, including poles, wire, cable and hardware, are reported by one manufacturer as ahead of last year.*

—CENTRAL-STATION EQUIPMENT SALES *are quiet; negotiations, while in fair volume, according to one manufacturer, are being attended with less pressure for quick delivery.*

Several specialties in the electrical line are reported quite active. Recent sales of electric furnaces, according to one manufacturer, are very encouraging; fewer inquiries for special types are being received, but orders for small units, up to 20 kw.; heat-treating furnaces, heating pot types and small process furnaces show a gain over last year's sales to date. Electric floodlighting equipment is notably active. Recently an order for 40 1,000-watt floodlights were placed for special display illumination to be used this season; in addition, over $10,000 will be expended for additional electrical equipment for display purposes in Boston.

CONSTRUCTION PROJECTS

Public Service Company of New Hampshire, Manchester, N. H., has acquired steam-electric power plant of Boston & Maine Railroad, near Franklin, N. H., for $600,000, and contemplates extensions and improvements, and transmission line addi-

tions. Edison Electric Illuminating Company, Boston, Mass., has filed plans for three power substations. American Brass Company, Waterbury, Conn., will build plant addition to cost $250,000. Board of School Trustees, Hartford, Conn., will receive bids until June 2 for equipment for power plant at Mansfield.

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EASTERN

—THERE IS A BETTER TONE *in the Eastern electrical equipment market and inquiries show noticeable improvement for the first time in several weeks. Central station demand is giving impetus to the situation and commitments are running to more appreciable amounts.*

—INDUSTRIAL ACCOUNT *gives indication of revival, particularly in connection with sizable orders. As a leading manufacturer expresses it, small business is dropping off, while larger orders are coming in. And there are few, if any, who will complain of this trend.*

The extraordinary activity in the copper market a week ago seems to forecast a definite turning point in the buying attitude. Cable and wire business is following along with some of the largest commitments in a number of months. A New York manufacturer has secured an order for cable from a power company in the northern part of the state, totaling $480,000. Another utility interest in the same district has contracted for a quantity of switchgear and transformers to cost $55,000. A metropolitan power company has given an order to a New York manufacturer for network protectors amounting to $30,000.

The New York Department of Transportation has closed with a state maker for substation apparatus costing $250,000. A Pennsylvania manufacturer will build two 35,000-kw. steam turbo-generator units for an installation in Virginia, the boilers to be furnished by a New York company. A municipality in Iowa has contracted with a Wisconsin maker for waterwheel generator units for a municipal station, totaling $125,184.

Industrial buyers are entering the market for late spring and summer requirements. A manufacturer of switches, controls and kindred equipment reports business as coming back in an encouraging manner; inquiries, however, are a little slow for this time of year. Iron and steel mills show recession in commitments during the past few weeks, while paper mills, chemical plants and affiliated industries give indications of improved demand before the turn of the month.

A manufacturer of Diesel engine units in western Pennsylvania is running on a capacity basis and reports good advance bookings. The General Railway Signal Company has secured a large contract for interlocking control units for a Canadian railway electric installation, totaling $1,500,000.

CONSTRUCTION PROJECTS

Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids for 32 electric generators and spare parts for Brooklyn Navy Yard, N. Y. (Schedule 3422); also, until May 27, for power transfer switchboards, etc., for same yard (Schedule 3358). Ford Motor Company, Dearborn, Mich., contemplates plant at Buffalo, N. Y., to cost over $1,000,000. Crucible Steel Company, Pittsburgh, Pa., contemplates plant additions to cost more than $500,000. American Steel & Wire Company, Cleveland, Ohio, will build two mill units at plant at Donora, Pa., to cost over $600,000.

The Chief of Engineers of the United States Army, Washington, D. C., will receive bids until May 27 for 15,000 ft., two-conductor cable, cable reels, etc. (Circular 27). General Purchasing Officer, Panama Canal, Washington, D. C., will receive bids until June 9 for transformers, insulators, insulated wire, conduit and other electrical supplies (Panama Circular 2563). Construction Division, Veterans' Bureau, Washington, D. C., will receive bids until June 3 for mechanical stoker for Veterans' Hospital at Lexington, Ky.

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SOUTHWEST

—WHILE NOTHING OF A *startling nature has transpired in the St. Louis district, the general feeling expressed by manufacturers and allied interests is entirely optimistic. Although there has been a slight falling off in the volume of sales in some lines, there now seems to be an upward tendency in the cotton-growing territory.*

There is some activity preparing for the approach of the ginning season. One power company has just purchased voltage-regulating apparatus to cost $20,000. Another order going to the same district was for a miscellaneous lot of motors and control apparatus amounting to $2,000.

CONSTRUCTION PROJECTS

St. Louis, Mo., plans power substation and airport lighting system. Union Electric Light & Power Company, St. Louis, Mo., has plans for addition to power substation. Central Kansas Power Company, Abilene, Kan., will build addition to power plant at Hoxie, Kan. Garnett, Kan., is having plans drawn and estimates of cost made for municipal power plant. West Texas Utilities Company, Abilene, Tex., will build addition to power plant and transmission lines at Stratford, Tex., to cost $100,000. Monroe, La., contemplates ornamental lighting system.

MIDDLE WEST

—GENERAL BUSINESS IN THE *Middle West section shows signs of considerable spottiness. The volume of business has increased somewhat. The consensus of opinion seems to be that the worst period for business has been passed, although no definite trend is apparent. The increased demand and higher price of copper are looked upon as stabilizing factors.*

—RAILROAD EQUIPMENT PURCHASING *has been exceedingly good and maintenance purchases are now showing improvement. More construction work is getting started and road building is under way. The various utility companies are proceeding along prearranged plans for gradual expansion.*

Some of the interesting orders placed this week include 1,000,000 lb. of copper, 200,000 lb. of solder, construction contract for service building structure to cost $700,000 and "Mazda" lamps valued at $150,000.

Jobbers' sales are still somewhat slow. While railroad business has been substantial, industrial business is somewhat off. There has been a fair demand for most appliances, with an excellent demand for electrical clocks and small motors.

CONSTRUCTION PROJECTS

Portland, Mich., plans extensions and improvements in municipal power plant to cost $60,000. Consumers Power Company, Jackson, Mich., plans addition to equipment storage and service building at Grand Rapids, to cost $75,000. Joliet, Ill., plans installation of airport lighting system. State Department of Public Welfare, Columbus, Ohio, will take bids in June for power plant at Cincinnati, to cost $250,000. Northern States Power Company, Minneapolis, Minn., will build addition to power plant at Minot, N. D. Elk Point, S. D., plans addition to municipal power plant. Central Power Company, Grand Island, Neb., plans addition to power plant to cost $80,000. Des Moines and Fort Dodge, Iowa, plan ornamental lighting systems.

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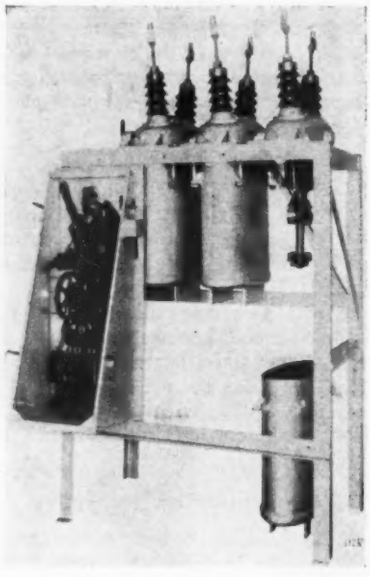
Secures Contract for Beauharnois Power Unit

THE CANADIAN GENERAL Electric Company has been successful in obtaining the contract for the first 200,000-hp. generator installation at the plant of the Beauharnois Power Corporation, on the St. Lawrence. The order consists of two 25-cycle, 50,000-hp. generators, two 60-cycle, 50,000-hp. generators and a further two 8,000-hp. units which will supply power for plant purposes and also excite the bigger machines. The contract calls for delivery of the generators by the spring of 1932.

New Equipment Available

Outdoor Breaker—5,000 Amp. at 15,000 Volts

AN OUTDOOR OIL CIRCUIT BREAKER of moderate interrupting capacity, known as type 0-11, for outdoor distributing services of 15,000 volts or less has been placed on the market by the Condit Electrical Manufacturing Corporation



of Boston. The design of the operating mechanism embodies the highly important feature of easy closure and at the same time affords ample pressure at the contact surfaces. The mechanism as a whole is designed to secure that acceleration of the movable contact member during the opening of the circuit which has proved to be the most efficient in circuit interruption.

The type 0-11 oil circuit breakers are furnished for 600 and 800 amp. The estimated interrupting capacity is 5,000 amp. at 15,000 volts and the breakers are furnished manually or electrically operated (a.c. or d.c.). Electrically operated breakers may be arranged for automatic reclosing service of one or more closing cycles with constant or varying time delay, affording minimum interruption to service.

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A SIMPLE, PRACTICAL RAKE to remove weeds and river trash of all sorts from the flume racks of hydro-electric plants is announced by the Winger Flume Rake Company, Osceola, Wis. This it accomplishes in an easy, efficient and therefore economical way. The rake can be installed without interrupting plant production, has practically no upkeep and may be designed for any depth and to suit any grating spacing. A 1-hp. motor, suitable drum hoist and trackage are sufficient accessory equipment. By maintaining the head-water level it will increase plant production, says the manufacturer.

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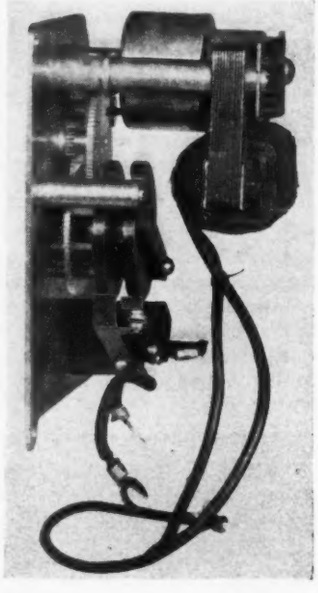
Opens and Closes Circuits on Prearranged Schedule

AN AUTOMATIC TIME SWITCH for closing and opening electric circuits at short predetermined intervals and on a uniform schedule is announced by the General Electric Company. Designated as type TSA, it automatically energizes a circuit to control intermittent operation of electric equipment. The time cycle may be a few minutes or several hours, and is repeated continuously. Owing to the short time of a cycle, one complete "on" and "off" period, the operation is without regard to the time of day; in this respect the type TSA time switches differ from the types T-8 and T-9 automatic time switches, which have 24-hour dials.

The switches are single-pole, with



one-way or two-way contacts, and are rated 5 amp. at 115 volts or 2½ amp. at 230 volts. On circuits of higher ampere rating a magnetic switch can be employed in conjunction with the time switch. The contact-making device is driven by a Warren "Telechron" synchronous motor, thus insuring accurate and reliable timing when connected to an alternating-current supply having the usual well-regulated frequency.

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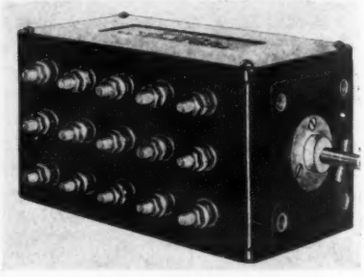
Meter and Relay Testing Switch

A NEW TEST SWITCH DESIGNED to facilitate testing of meters and relays has been announced by the Meter Devices Company, Canton, Ohio. It has been named "Roto-Test" and consists of



a one-piece bakelite case, with removable top and bottom covers, in which is mounted a rotor on a square steel shaft. This shaft extends through the front of the case and becomes the medium for operating the switch by use of a specially designed key.

These switches are made in four, six, eight and ten-pole combinations for switchboard mounting. An interlocking feature provided by the faceplate prevents the key from being withdrawn after test until the switch is restored to service position. The switch can be applied to any type of switchboard and used with all standard makes of instruments, meters and relays. Overcurrent relays may be tested in any one phase without disturbing the others.

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Single-Pole Limit Switch

A NEW SINGLE-POLE LIMIT SWITCH for general service is announced by Cutler-Hammer, Inc., Milwaukee, Wis. A small, sturdy device, it can be applied on machine tools, conveyors, dough mixers, washing machines and other small equipment, to start, stop or reverse the motor at its limits of travel. Two types are furnished, one with normally closed contacts which are opened when the operating roller is depressed and the other with normally open contacts which are closed when the roller is depressed.